1 INTRODUCTION

The Army Low Impact Development Technical User Guide provides guidance for the planning and design of Low Impact Development (LID) on construction projects in order to comply with stormwater requirements and resource protection goals that effect Army construction.

1.1 LEGISLATION AND POLICY

Army installations have traditionally been required to comply with a number of federal regulatory programs associated with non-point source stormwater discharges. Recent Federal legislation, Executive Order, Secretary of Defense and Secretary of the Army policy require the implementation of LID as a means to manage stormwater.

The Department of Defense (DoD) definition of LID is as follows:

> Low Impact Development (LID) is a stormwater management strategy designed to maintain site hydrology and mitigate the adverse impacts of stormwater runoff and nonpoint source pollution.
>
> LID actively manages stormwater runoff by mimicking a project site's pre-development hydrology using design techniques that infiltrate, store, and evaporate runoff close to its source of origin. LID strategies provide decentralized hydrologic source control for stormwater runoff. (UFC 3-210-10)

1.1.1 EISA Section 438

In December 2007, Congress enacted the Energy Independence and Security Act (EISA) of 2007. EISA Section 438 establishes strict stormwater runoff requirements for federal development and redevelopment projects. The provision reads as follows:

> **"***Storm water runoff requirements for federal development projects.* The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre-development hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

1.1.2 Executive Orders (EO) 13514

Executive Order 13423, Strengthening Federal Environmental Energy and Transportation Management (2007) and Executive Order 13514, Environmental Energy and Economic Performance (2009) both have goals for the reduction of potable water and a zero carbon footprint. EO 13514 enhances previous EOs on water and energy and requires adherence to EISA Section 438. This EO also directed the EPA to develop the *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* (EPA, 2009), which provides federal agencies with a

foundation for developing policies and procedures to comply with the regulations (see Chapter 4 and Appendix A).

1.1.3 OSD EISA Section 438 Implementation Memorandum

The Office of the Under Secretary of Defense (OSD) memorandum, *DoD Policy on Implementing Section 438 of the Energy Independence and Security Act (EISA)*, January 2010 is the DoD Policy on Implementing Section 438 of EISA. This memorandum states that DoD shall implement EISA Section 438 and the EPA Technical Guidance using LID techniques. The overall design objective for each project is set to maintain predevelopment hydrology and prevent any net increase in storm water runoff. DoD defines "predevelopment hydrology" as the pre-project hydrologic conditions of temperature, rate, volume, and duration of storm water flow from the project site.

1.1.4 Army Sustainable Design and Development Memorandum

The Department of Army memorandum, *Sustainable Design and Development Policy Update*, October 27 2010, establishes the mandatory policy requirements for stormwater facility construction, regardless of funds source. The memorandum requires stormwater management to comply with EISA Section 438 and be consistent with the EPA Technical Guidance by incorporating LID. All master planning, project development and project site planning should follow guidance as detailed in ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers) Standard 189.1 Section 5, and incorporate LID criteria, maximize use of the existing topography including slope, hydrology, flora and soils, and minimize site clearing and soil grubbing activities to the greatest extent possible.

1.1.5 LEED™ Construction Requirements

LEED is a green building certification system that was developed and is maintained by the U.S. Green Building Council (USGBC). The USGBC and LEED promote sustainable building and development practices through a suite of rating systems that recognize projects that implement strategies for better environmental and health performance.

> The LEED system provides numerous opportunities to use LID within the building footprint, the site plan, and the infrastructure to achieve the desired rating system level. This includes retaining runoff on-site, harvesting stormwater and runoff, and using green design techniques.

The Sustainable Design and Development Policy Update (described above in Section 1.1.4) requires that starting with the FY13 military construction program, all vertical construction will incorporate sustainable design principles into site selection, design and construction. All such construction, to include comprehensive building renovations, will be certified at the LEED-NC/MR SILVER level or higher from the Green Building Certification Instituate (GBCI) and will be built following guidance as detailed in ASHRAE Standard 189.1. Integrating LID into the building envelope can help achieve several credits in the Sustainable Sites and Water efficiency categories. A detailed description of each of the credits and how to achieve them is included in Appendix A.

1.2 LOW IMPACT DEVELOPMENT PHILOSOPHY

LID is a rapidly growing concept in stormwater management that began in Prince George's County, Maryland, in the early 1990's. LID was developed to address runoff issues associated with new residential, commercial, and industrial suburban development in Prince George's County, to protect the natural resources of the county (Prince George's County, MD, 1999). LID presents a paradigm shift from treating stormwater as something to be moved quickly from the site to managing stormwater as a valuable resource on a site.

> LID Design for EISA Section 438
>
> LID design is based on "mimicking" the pre-project hydrology of a site by replicating the natural hydrology of the site to manage stormwater runoff. LID design utilizes the existing features on a site to plan for non-structural and structural LID BMPs.

Hydrology is an organizing principle that is integrated into site planning and even installation level planning. Development increases impervious areas and impacts natural hydrology, causing erosion, sedimentation, habitat loss, and water quality degradation. Managing stormwater through the use of integrated small scale LID BMPs provides for infiltration, filtration, evaporation, detention and storage to control stormwater runoff discharge, volume, frequency; maintain water temperatures; and provide pollution prevention opportunities. The primary goal of LID is to mimic a site's pre-development hydrology by managing stormwater runoff close to its source. LID integrated across a project site, and especially into installation level planning, brings about a decentralized and holistic approach to the management of stormwater runoff. Further detail about hydrologic impacts of development and LID can be found in Chapter 2.

1.2.1 LID Fundamentals

The LID approach is based on managing stormwater at the source by the use of planning techniques, known as non-structural LID BMPs, and microscale controls, known as structural LID BMPs, that are distributed throughout the site in order to maintain the pre-project hydrologic function of the site. This is unlike conventional approaches that typically convey and manage runoff in large ponds located at the base of drainage areas. Primary consideration must be given to these key elements:

> LID Principles
>
> - Maintain pre-project hydrologic functions through natural processes.
> - Maintain drainage patterns and watershed timing.
> - Minimize development impacts through non-structural practices.
> - Use distributed BMPs to meet hydrologic goals.

- Maintain pre-project hydrologic functions through preserving the natural landscape. Reduce land clearing and grading activities that impact the hydrology of the site. Direct runoff to natural areas and promote infiltration and recharge to natural features.

- Maintain drainage patterns and watershed timing. Provide a customized site-design that incorporates a holistic approach to ensure hydrologic function on site and within the watershed. Minimize development impacts through non-structural LID practices.

- Use distributed LID BMPs to meet hydrologic goals. Employ a series of small scale controls (micromanagement) on site that work together to alleviate hydrologic impacts.

- Maintain the small-scale controls to ensure efficiency and effectiveness in terms of both water quantity and quality functions, to include pollution prevention. Educate maintenance crew and the public about the functions of LID to ensure proper maintenance and the longevity of controls (UFC 3-210-10, 2010).

Understanding the goal and key elements of LID provides a background for planners, designers, engineers and stormwater managers to begin the site planning process to achieve stormwater management requirements.

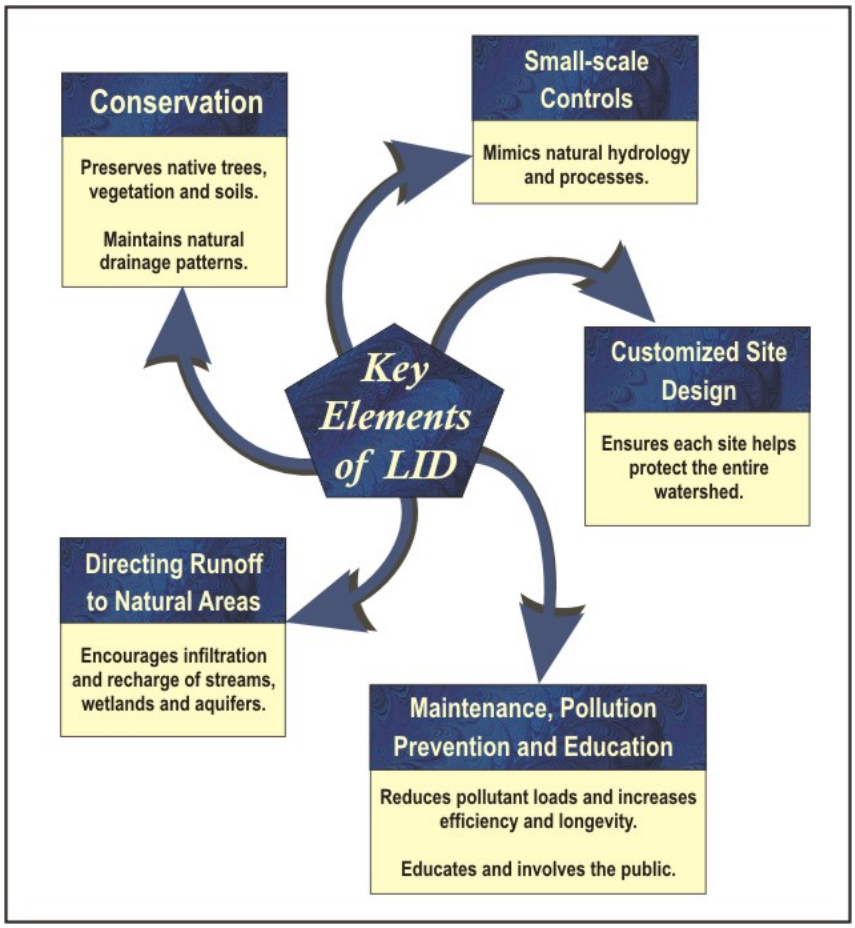

Figure 1-1. Key Elements of LID
(Source: Whole Building Design Guide, 2010)

1.2.2 Benefits of LID

There are a multitude of benefits from integrating LID into a project to include environmental, economic, social, water quality and watershed-scale benefits. Environmental benefits include preserving and protecting the natural ecosystem, protecting habitat, recharging groundwater, and protecting surface waters for both water quantity and water quality. Economic benefits include a

reduced infrastructure and utility maintenance costs (streets, curbs, gutters, sidewalks, storm sewer), minimized cost for clearing and grading, and reduced permit fees (i.e., Clean Water Act requirements). Social benefits include reduced risk of flooding, aesthetically pleasing LID features, improved water quality for drinking and recreational water bodies, and increased groundwater recharge that may be used for drinking water. Improved water quality and maintaining the natural hydrology of the site prevents habitat degradation, lowers strain on stormwater infrastructure, preserves quality of drinking water, and lowers risk of floods.

1.3 STORMWATER MANAGEMENT REGULATIONS

Army installations are subject to federal, state, and local stormwater management regulations for construction projects. The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The National Pollutant Discharge Elimination System (NPDES) Section 402 program focuses on point and non-point sources of stormwater runoff and pollution. The state and local requirements for stormwater management vary throughout the country. Incorporating LID into construction projects and across Army installations may help meet the requirements set forth in the NPDES program.

> Army installations must comply with an often complex set of federal, state, and local regulations that can have very different goals, objectives, and requirements. LID can be used as a standalone strategy or in conjunction with other stormwater approaches to meet these requirements.

1.3.1 National Pollutant Discharge Elimination System (NPDES)

As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Since nonpoint source runoff enters these conveyance systems, land development activities are covered as point sources. Industrial, municipal, and other facilities (Army facilities) must obtain permits if their discharges go directly to surface waters. The NPDES program is focused on a municipal program, construction program, and an industrial program, all of which present opportunities to include LID strategies and techniques. This program is administered by either the EPA or the State; many States have been authorized by EPA to operate the NPDES stormwater program.

For construction projects, construction site operators engaged in clearing, grading, and excavating activities that disturb one (1) acre or more, including smaller sites in a larger common plan of development or sale, are to obtain coverage under an NPDES permit for their stormwater discharges. Construction site operators are required to develop a Storm Water Pollution Prevention Plan (SWPPP) to include erosion and sediment controls. LID practices, non-structural and structural, can be used to manage stormwater quantity and quality during the construction process.

Municipal stormwater discharges and industrial discharges are also regulated through the NPDES program. Army facilities may require a permit for these activities as determined by

State regulations. LID practices can be employed to help meet the requirements of these stormwater permits by reducing stormwater discharge.

Table B-1 in Appendix B is a list of current state NPDES and regulatory programs.

1.3.2 Additional Regulations, Policies, and Resources

The planning, design, and maintenance of buildings, infrastructure, training areas, and open space is based on numerous policies, Army regulations (AR), Unified Facilities Criteria (UFC), and Public Works Technical Bulletins (PWTB). These documents provide the framework for Army construction, including LID BMPs. Listed below are some of the key documents that will be referenced in this Technical User Guide:

AR 420-1, Facilities Management
PWTB 200-1-62, Low Impact Development for Sustainable Installations
UFC 1-200-01, Design: General Building Requirements
UFC 2-100-01, Installation Master Planning
UFC 3-210-01A, Area Planning, Site Planning, and Design
UFC 3-210-05FA, Landscape Design and Planting Criteria
UFC 3-210-06A, Site Planning and Design
UFC 3-210-10, Low Impact Development
UFC 4-010-01, Design: DoD Minimum Antiterrorism Standards for Buildings
UFC 4-030-01, Sustainable Development

Appendix A includes further LID references.

1.4 ARMY STORMWATER MANAGEMENT USING LID

Incorporation of LID BMPs into the Army's construction program is the methodology used to meet requirements of Section 438 of EISA and DoD and Army policy regarding stormwater management. The Army Guidance, "Army Stormwater Management Using Low Impact Development", provides a framework for planning and implementing LID in Army construction projects.