



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON, DC 20310-0600

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MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: 2017 Implementing Guidance, Army Stormwater Management Using Low Impact Development

1. References.

a. Memorandum, ASA(IE&E), 17 Jan 2017, subject: Sustainable Design and Development Policy Update

b. Memorandum, Deputy Under Secretary of Defense (Installations and Environment), 19 Jan 10, subject: DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA)

2. All increases in storm water runoff resulting from construction is to be managed on-site through the use of low impact development (LID) features called best management practices (BMPs). HQDA developed, and land holding commands have concurred with, the update to the 2015 version of LID implementing guidance titled "2017 Implementing Guidance, Army Stormwater Management Using Low Impact Development" available at the USACE Hydrology and Low Impact Development website <https://mrsi.erdcdren.mil/sustain/cx/lid/>

3. Request your implementation of the enclosed subject guidance to meet Army LID policy found in reference 1a. The enclosed guidance remains effective until it is superseded by regulation. My point of contact for this action is [REDACTED] ODC, [REDACTED]

FOR THE ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT:

Encl
as

JOY L. CURRIERA
COL, AG
Director, Operations

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References.

1. Title 42, USC, Chapter 52, Section 17094, Section 438 Energy Independence and Security Act, December 2007.
2. Memorandum, Deputy Under Secretary of Defense (Installations and Environment), 19 Jan 10, subject: DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act (EISA).
3. Memorandum, Assistant Secretary of the Army (Installations, Energy and Environment), ASA(IE&E), 17 Jan 2017, Subject: Sustainable Design and Development Policy Update.
4. Memorandum, ASA(IE&E), 20 Dec 12, subject: Water Goal Attainment Responsibility for Installations
5. Army Regulation (AR) 420-1, Army Facilities Management, Feb 2008
6. UFC 1-200-02, High Performance and Sustainable Building, Dec 2016.
7. AR 210-20, Real Property Master Planning for Army Installations, May 2005
8. Unified Facilities Criteria (UFC) 2-100-01, Installation Master Planning, May 2012
9. UFC 3-210-10, Low Impact Development, Feb 2016
10. Army Low Impact Development Technical User Guide, Jan 2013

1. General. Implementing low impact development (LID) stormwater management features called best management practices (BMPs) provide the Army with increased sustainable solutions and help the Army achieve High Performance Sustainable Buildings and Installations.

a. Incorporation of LID BMPs into the Army's construction program is the method used to meet requirements of Section 438 of the Energy Independence and Security Act (EISA), Department of Defense and Army policy regarding stormwater management. The design objective of LID is to maintain or restore the predevelopment (pre-project) hydrology of the property with regard to the temperature, rate, volume, and duration of flow. The pre-development hydrology is the hydrology of the site prior to the planned project being carried out.

b. Low impact development BMPs actively manage 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. In planning and development of installations, we must plan more holistically, around designated area development

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districts. We must look at more multi-use and compact, multi-story solutions that reduce the development footprint, incorporating designs that minimize impervious surfaces.

c. Implementation of this guidance will reduce the number and size of conventional stormwater construction practices of the past (i.e. curb and gutter, storm drain inlets, retention and detention basins). When properly implemented, LID BMPs will maintain and/or restore pre-development hydrology and remove pollutants such as nutrients (nitrogen and phosphorus), oil and grease, and sediments from stormwater with minimal land requirement, when compared to traditional stormwater practices.

d. Installation/activity commanders and installation managers, master planners, design engineers, stormwater program managers, maintenance personnel, land users, tenants, U.S. Army Corps of Engineers and all construction contractors are integral to the successful implementation of LID within the Army's construction program. Effective master planning and site planning are critical aspects of implementing sustainable practices across Army installations. If Army installations are truly to be sustainable, we must systematically change the way we manage stormwater which requires a commitment to LID principles in the installation-wide visioning and planning processes as well as implementing these principles through area development plans and site specific planning actions.

2. Applicability.

a. This guidance applies to all construction and renovation projects on Army installations, sites, enclaves and activities, regardless of funding source including Government Owned Contractor Operated (GOCO) installations, and all Army National Guard projects that receive federal funds, with a limit of disturbance (LOD) of 5,000 SF or more in area.

b. Exceptions to policy and this guidance include privatization initiatives (housing and utilities) and medical facilities constructed using DoD Medical (DoDM) funding. At Joint Installations, the owning Service guides all construction policy and guidance. If the Navy or Air Force builds on Army installations, they will comply with Army policy and guidance. For overseas construction activities at enduring locations, this guidance applies except where there is direct conflict with Host Nation agreements. In those instances, installations/activities will strive to achieve LID approaches consistent with applicable host nation requirements and operate in accordance with applicable international agreements, e.g., Status of Force Agreements. Construction in contingency areas (and incorporating semi-permanent or better construction standards) is to incorporate this policy to the greatest extent practicable considering mission objectives.

c. The requirement to incorporate LID as a means to manage stormwater differs when comparing what is written in the Army Sustainable Design and Development Policy Update Memo (reference 3) with the Low Impact Development UFC (reference

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9). Army policy is required to be followed in all Army construction, therefore LID is required to be incorporated in all Army horizontal and vertical construction that meets the criteria in this guidance.

3. Project Planning and LID. Implementation includes completion of the requirements identified in the following subparagraphs: site selection, site planning, runoff assessment, LID BMP strategy, cost estimating and reporting. The implementation process includes use of the Army LID Planning and Cost Tool. It is necessary that the "Tool" and "User Guide" located in the Design Tools section of the Hydrology and LID webpage: <https://mrsi.erdc.dren.mil/sustain/cx/lid> be saved to your computer for use (see the "Example" project loaded in the Tool as a reference).

a. Site Selection. The installation/activity Master Planner is responsible for providing an approved project site. Site selection includes a review of the natural drainage patterns (micro-sheds) to take advantage of natural slope on the planned site and incorporates a strategy to minimize: tree removal, soil grubbing activities and disturbance to sensitive areas/habitats and protected cultural resources. Give consideration to the location and overall design of LID BMP structures so overflows may be tied to existing stormwater conveyance systems as necessary.

b. Site Planning. The use of LID BMPs in the management of stormwater warrants a broad holistic approach that addresses the development of watershed areas across our installations, sites, enclaves and activities. The installation/activity Master Planner, shall include LID considerations for stormwater management throughout the planning and programming process, to include initial visioning, installation planning standards (IPS)/installation design guide (IDG) principles, area development planning, and ultimately site planning for specific facilities. Reducing impervious surface and promoting infiltration, where possible, should be a goal throughout the planning and programming process.

c. Runoff Assessment. All installation/activity construction projects must start with developing a runoff assessment in order to determine the stormwater requirements required to be met using LID. The assessment identifies any increase in runoff resulting from the project which forms the basis for a LID BMP Strategy and is developed through use of the Army LID Planning and Cost Tool. Use the planning and cost tool "User Guide" as a tutorial on how to enter installation/activity project criteria.

(1) Limit of Disturbance. Identify the project "site boundary" (in acres) as the estimated limit of disturbance (LOD). Planning the site boundary as the LOD provides adequate space to locate LID BMPs on the site and supports LEED scoring. The estimated LOD is identified during the planning and concept design phases and finalized during the design process.

(2) Runoff Required to be Managed. Use the project "Example" loaded in the

"Tool", and the Tool "User Guide" to become familiar with the data fields needed to initiate a new project and address any issues you may have.

i. Once the LID BMPs are selected and sizes are planned, the Cost Tool can be used to calculate planning level costs of construction and maintenance and assists in completion of programming documents, such as a DD 1391, to ensure the quantity of LID BMPs and estimated costs are incorporated into the project.

ii. In addition, the LID Planning and Cost Tool "Report" feature summarizes project inputs and outputs and begins populating the information needed for annual reporting.

d. LID BMP Strategy. The Master Planner develops the LID BMP strategy by selecting the "Type" and "Quantity" of each LID BMP considered for inclusion in the project. The Master Planner should consider the IPS/IDG, area development plans and installation network plans where available to identify LID BMPs that complement installation master planning strategies. The Master Planner coordinates with the DPW Engineer to finalize the strategy.

(1) Once a LID BMP type and associated quantity is selected the tool auto-calculates how much runoff is managed/retained by the BMP. The amount of runoff managed/retained is a function of the type and design of the BMP selected: bioretention, drainage swale, permeable pavement, rainwater harvesting, green roof, and infiltration practice.

(2) LID BMPs identified in the Army LID Planning and Cost Tool are cumulative by BMP type. As an example, If you select 100,000 SF of bioretention and you decide it will be broken up into several different BMPs you are to enter 100,000 SF in the planning tool and identify each BMP separately as LID 1 ..., LID 2 ..., etc. (followed by a description) in the Text Box at Tab J, Storm Drainage / Low Impact Development until the total square footage of the separate BMPs matches the square footage identified in the "Tool".

(3) Multiple types of LID BMPs may be incorporated into a project site. The LID BMP Strategy may include a treatment train (LID BMPs in series) and in some instances may be required to meet enhanced stormwater management and water quality criteria. Consolidation and/or diversion of stormwater to retention/detention ponds is not an acceptable LID BMP practice.

(4) Planners and designers must be careful when planning to incorporate LID BMPs into parts of projects that have a potential to contribute to environmental contamination. As an example, LID BMPs designed for infiltration are not appropriate for use where end user activities include petroleum, oil and lubricants (POL) offloading, fueling, hazmat/waste loading/unloading, etc. Instead stormwater will be managed or diverted in such a way that any spills will minimize impact on the environment. In order

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to ensure integrity of the environment, project planners and engineers may consider unique and innovative methodologies on the project under consideration and may apply LID mitigation initiatives to other areas within the watershed.

(5) Long term operation and maintenance costs are to be incorporated in the decision process when determining which BMPs to include in a LID BMP Strategy.

e. Cost Estimating. The LID Planning and Cost Tool "Report" provides a planning level cost estimate (*in today's dollars*) and is not to be substituted as a detailed cost estimate developed during design and construction phases.

f. Reporting. An Army LID Planning and Cost Tool Report is required to be completed and attached to Tab J of all DD1391's for MILCON projects or kept in the DA 4283 project file for non-MILCON projects. Optional reporting of LID BMPs constructed in "Completed Construction Project Data" may be submitted in the LID module of the Army Energy and Water Reporting System (AEWRS) website <https://aewrs.hqda.pentagon.mil/>. While optional, the LID module in AEWRS serves as an excellent tool to provide a permanent record of LID BMPs constructed. Reporting is the responsibility of the installation/activity Master Planner.

(1) Planning Report. Upon completion of the LID BMP Strategy and Planning Level Cost Estimate through use of the Army LID Planning and Cost Tool, the Master Planner clicks on the "View Report" button to obtain the Army LID Planning and Cost Tool Report. The report shows project site details, runoff volume required to be managed on-site, LID BMP Strategy, and estimated costs for the types of LID BMPs selected. This report demonstrates planned compliance with EISA, DoD and DA stormwater policy.

i. The Army LID Planning and Cost Tool Report is required to be saved as a pdf file and uploaded to the Storm Drainage / Low Impact Development section of Tab J for the DD1391 (see Appendix A). When using a local job order (DA 4283), The Army LID Planning and Cost Tool Report is required to be included in the 4283 Project File.

ii. A narrative description of each LID BMP and starting with LID 1 ..., LID 2 ..., etc. that makes up the LID BMP Strategy is to be included in the Storm Drainage / Low Impact Development "Text Box" at Tab J (see Appendix B).

iii. The estimated planning level costs for LID BMPs are required to be included in Tab A Cost Estimate in the Supporting Facilities Section of the DD1391. The cost estimate will use the nomenclature established in the Tab J, Text Box, i.e. LID 1 bioretention, LID 2 bioretention, LID 3 drainage swale, etc. and making up the LID BMP Strategy (see Appendix C).

iv. The Army LID Planning and Cost Tool Report is to be carried forward being updated along with other project documentation in the 1391 or 4283 as applicable, up to

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the "Initial Design Phase."

Note: When using the Army LID Planning and Cost Tool It is recommended the file be saved frequently. Ensure to use a new file name each time you enter a new construction project.

(2) Project Completion Report. Upon project completion, LID BMP construction details may be reported in the LID module of AEWRS. The LID module provides the installation a location to maintain a permanent record of LID BMPs incorporated in construction projects.

(i) Reporting in AERWS is recommended for all new construction and redevelopment projects completed on installation/activity grounds during the fiscal year of report.

(ii) The center (*centroid*) of each LID BMP is used to identify its location and is the HQDA approved Installation Geospatial Information and Services (IGI&S) methodology.

4. Project Execution and LID.

a. Planning Charrette. The Master Planner provides the LID BMP Strategy to the planning charrette (PC) team members. The PC attendees provide input into the strategy to enhance management of stormwater runoff.

b. Initial Design Phase (Code 2, 3). The following subparagraphs outline the general process to include LID in project design.

(1) The USACE Geographic District calculates and validates the runoff volume required to be managed during the planning/design charrette. The LID BMP Strategy continues to be refined and BMP cost estimates are to be updated using the "Tool" for estimated planning level costs and incorporated in the ENG Form 3086. Note: For non-USACE projects, the designer of record is responsible to plan and design LID BMPs capable of managing any increase in site runoff.

(2) All planned changes to the LID strategy are required to be coordinated through the installation/activity Master Planner to develop consensus and approval. Low impact development is not to be cost engineered out of the project.

(3) LID BMPs are incorporated into the project definition report (PDR). Refined LID BMP cost estimates are developed in the ENG Form 3086 process. Each LID BMP is identified using LID 1 ..., LID 2 ..., etc. and totals (amounts of BMPs) are developed in the Army LID Planning and Cost Tool Report.

(4) Once the project becomes approved, the LID BMP strategy will be carried

forward into the project final design. Contract documents will reference stormwater management criteria/standards from updated IPS/IDG that meet the intent of the Army LID policy found in reference 3 and this guidance. Where the IPS/IDG has not been updated, this guidance may be referenced. The LID BMP strategy, designs and supporting documentation will be provided to support LID implementation through the RFP process as necessary.

c. LID Strategy Change Management. Changes to the LID BMP strategy must meet the requirements of Army LID policy; EISA, section 438 and state and local regulation. In all instances where modifications/wholesale changes to the LID BMP strategy are planned, the USACE Geographic District representative will coordinate with the installation/activity Master Planner on proposed new LID courses of action and develop consensus on how to best meet LID requirements.

d. Construction Phase. The construction representative will conduct routine inspections of LID BMPs to ensure they are constructed per the final designs. Any required changes to the strategy during construction will be coordinated with the Master Planner for approval. Any construction change orders must be approved by the LID BMP designer of record. Upon completion of construction and at project closeout, BMP as-built documentation will be provided to the installation/activity DPW or equivalent. The LID BMPs will be identified on the DD Form 1354.

e. Real Property Inventory. All structural LID BMPs meet the definition of real property and require a real property unique identifier (RPUID) number. LID BMPs are to be included in the accountable property systems of record (APSR), coded with a category code and included in the sustainment model. Master Planners are to use CATCODES that best accommodate the LID BMPs constructed on their installations/activities. New LID BMP specific CATCODES are being pursued through appropriate channels at HQDA.

f. Operation and Maintenance. A LID BMP Owner's Manual is required to be included as a deliverable in the contract and contain the processes used to maintain the BMP to ensure proper operation is achieved. The manual is provided to the Directorate of Public Works or equivalent.

5. Contract Language. The following example contract language is provided for use in the event a garrison/activity commander should choose to have the project Designer of Record, develop reporting data elements. Example contract language: "Upon project completion the Designer of Record shall provide all data points in the L I D m o d u l e o f A E W R S located in Appendix D. The Designer of Record will provide the completed report form, and an Owner's Manual that identifies a schedule of all required BMP maintenance to the Installation Directorate of Public Works or equivalent as part of the DD Form 1354 Transfer and Acceptance of DoD real property contract close-out process."

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6. Exceptions to Policy. Garrison Commanders may request an exception to policy if LID BMP implementation would adversely affect mission performance, security, or Antiterrorism/Force Protection requirements, health, safety or welfare, or in instances where the exception is directly related to the technical infeasibility of LID BMP performance. The exception request will be provided as follows.

a. The Garrison Commander submits a request through the chain of command, to the Director, Operations Directorate, Office of the Assistant Chief of Staff for Installation Management, Attn: DAIM-ODC, 600 Army Pentagon, Washington, DC 20310. Upon review the OD Director will forward a recommendation of acceptance/denial to the Deputy Assistant Secretary of the Army for Installations, Housing and Partnerships (DASA(IH&P)).

b. The memorandum request is to include: Subject: Exception to Policy Request to Incorporate LID in (*Project Name*) Based Upon (choose either *Mission Impact/Security/Technical Infeasibility*), A summary statement that demonstrates why LID BMP implementation is not practical for the specific project, the DPW master planner name, installation/ activity address, email and phone number, the name and company of LID design engineer(s), project type considered, site location (using GPS coordinates), watershed name (per state/EPA), engineering calculations, geologic reports, hydrologic analyses and site map.

7. Considerations.

a. Site Management. Tree clearing and soil grubbing activities are to be reduced to the maximum extent possible, but are not to impede contractor requirements for storage, parking, delivery, and other specific project requirements, e.g. developing clear zones for airfield construction. LID BMPs are to be constructed within the LOD. Native vegetative cover will be maintained and replaced as necessary. Projects must take into account the location of protected species, sensitive areas/habitats, and protected cultural resources sites, avoiding these areas whenever possible.

b. Ties to Traditional Stormwater Systems. Proper LID BMP designs may require drain disconnects, underdrain (overflow) connections or reconfigurations to existing traditional storm sewer systems.

c. Stormwater Harvesting. Installation/activity Master Planners should consider stormwater harvesting in order to meet both water quantity and quality requirements. Stormwater harvesting may be used to achieve numerous objectives all while managing runoff rate and volume. The use of cisterns and the installation of interconnected pipe networks below parking areas to store runoff are just a couple of techniques for consideration. Water storage under parking and drive areas accessible to tactical vehicles, e.g. Striker, MRAP and tanks must be given special consideration during scoping and budgeting to ensure proper project design. Stormwater re-use includes but is not limited to: process makeup water, irrigation, grey water (purple pipe), personal

and tactical vehicle wash, and emergency firefighting requirements. It is imperative for garrison DPW staff including Operations and Maintenance personnel to understand O&M requirements to ensure proper BMP function once complete. Site conditions of these storage areas including elevation/grade and soil conditions may necessitate pumping and other maintenance burdens to be included in garrison O&M requirements. When a cost benefit analysis seems appropriate prior to project consideration it should take into account a minimum 50-year project period and use the 95th percentile storm event. Calculations and supporting analysis must remain part of the design documentation. Projects located in jurisdictions that forbid stormwater harvesting (e.g. riparian water rights) are exempt from consideration.

d. Retention/Detention Ponds. Land is a dwindling Army resource. Stormwater retention and detention ponds take up valuable space, are not considered LID BMPs and are highly discouraged. Traditional retention and detention ponds do not provide for maintaining pre-development hydrology, allow for minimal infiltration, and provide minimal water quality benefits.

e. Training Areas. Construction projects in training areas greater than 5,000 S F in size will incorporate LID BMPs as the methodology to manage stormwater. Construction of roadways, trails, ranges, pads etc. will incorporate LID BMPs to the greatest extent possible.

f. Demolition. Project activity including demolition must be evaluated to ensure any increased runoff from the site is managed using LID principles.

g. Stormwater Modeling. Installation/activity DPW Engineer and USACE Geographic District PMs are responsible for maintaining all pertinent site modeling data and calculations.

h. Practical Application. In all instances LID BMPs are to meet local, state and federal requirements for management of stormwater and will be incorporated into projects in an attempt to restore pre-project hydrology. As a general rule, EISA compliance is accomplished through management of the difference in pre and post project runoff from the 95th percentile rain event. This calculation is based on the difference in runoff coefficient for the pre and post project land cover. Each planned LID BMP is modeled to determine its ability to manage an amount of runoff. The volume of water that each LID BMP is capable of managing is cumulative across the site boundary and must be greater than the amount of increased runoff from the site.

i. Watershed Approach. It should be pointed out that modeling of LID BMPs using the LID Planning and Cost Tool (during the Planning Charrette and/or Design Charrette) may not be sufficient to address planned/future state requirements for water quality and/or quantity issues related to construction permits (see the Modeling Section in the Army LID Tech User Guide). Watersheds including micro- sheds can have a variety of unique challenges including: threatened and endangered species, historical properties,

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invasive species, soil instability and erosion, aggressive/steep slope, current and planned development and associated runoff and others. Installation DPW personnel must remain knowledgeable of construction permit requirements and may be required to institute an enhanced modeling approach to meet future requirements. Modeling would be used to determine the effect of the planned project construction and results will be incorporated into the designated development area as cited in the installation master plan. To restore a site to pre-project hydrological conditions an installation/activity may need to consider a broad area/community or development approach. Project success may involve the cumulative effect of LID BMP initiatives, as single features by themselves may not be capable of restoring the site to pre-project hydrologic conditions.

j. LID Guidance and Support. The USACE Hydrology and Low Impact Development site: <https://mrsi.erdcdren.mil/sustain/cx/lid> is a resource for legislation, policy, guidance and tools for use in development of Army projects. Army LID implementation will be accomplished using Army Implementing Guidance (this document), the Army LID Planning and Cost Tool (see Design Tools section of the mrsi site), and the Army Low Impact Development Technical User Guide (see Best Practices section of the mrsi site). The Technical User Guide provides practical planning and design examples on how to construct successful LID BMPs. Design criteria can be found in the Low Impact Development UFC 3-210-10. Other professionally recognized industry standards including guidance developed by the Service components should be considered if it is not available from the Army, Department of Defense (DoD) or EPA.

APPENDIX A

Army LID Planning and Cost Tool Report

PROJECT INFO		SITE INFO AND EISA VOLUME REQUIREMENT	
Date	<input type="text" value="7/21/2016"/>	Project limit of disturbance (AC)	<input type="text" value="6"/>
Army command	<input type="text" value="IMCOM"/>	95% rainfall depth (IN)	<input type="text" value="1.6"/>
Army installation	<input type="text" value="Fort Meade"/>	Soil type	<input type="text" value="Sandy-Loam"/>
Project name	<input type="text" value="Example"/>	Hydrologic Soil Group (HSG)	<input type="text" value="B"/>
Project description	<input type="text" value="new building and parking lot"/>	Pre-project curve number (CN)	<input type="text" value="58"/>
User Name	<input type="text" value="EMC"/>	Post-project curve number (CN)	<input type="text" value="83"/>
Master Planner	<input type="text"/>	Pre-project runoff volume (CF)	<input type="text" value="68"/>
		Post-project runoff volume (CF)	<input type="text" value="9529"/>
		EISA section 438 retention volume requirement (CF)	<input type="text" value="9462"/>

LID PLANNING SUMMARY

Structural BMP	Surface area (SF)	Runoff volume retained (CF)	Non-structural BMP	Surface area (AC)
Bioretention:	<input type="text" value="5000"/>	<input type="text" value="4060"/>	Veg. Filter Strip (Slope >2%, Short Grass):	<input type="text" value="0.00"/>
Swale:	<input type="text" value="3000"/>	<input type="text" value="1607"/>	Veg. Filter Strip (Slope >2%, Tall Grass):	<input type="text" value="0.00"/>
Permeable pavement:	<input type="text" value="20000"/>	<input type="text" value="2667"/>	Veg. Filter Strip (Slope <2%, Short Grass):	<input type="text" value="0.00"/>
Rainwater harvesting:	<input type="text"/>	<input type="text" value="0"/>	Veg. Filter Strip (Slope <2%, Tall Grass):	<input type="text" value="0.00"/>
Green roof:	<input type="text" value="15000"/>	<input type="text" value="1500"/>	Reforestation (Trees - Short Grass):	<input type="text" value="0.00"/>
Infiltration practice:	<input type="text" value="2000"/>	<input type="text" value="1624"/>	Reforestation (Trees - Shrubs and Tall Grass):	<input type="text" value="0.00"/>
Total retention volume provided by BMPs (CF):		<input type="text" value="11457"/>		

Project complies with EISA Section 438.

LID COST SUMMARY

Type	Surface Area (SF)	Estimated Construction Cost	Estimated Annual Maintenance Cost
Bioretention	5000	\$178,198.80	\$41,998.17
Drainage swale	3000	\$33,093.88	\$28,497.23
Filter strip	0	\$0.00	\$0.00
Infiltration trench	2000	\$165,831.82	\$20,560.66
Permeable concrete pavers	20000	\$963,431.04	\$72,893.05
Pervious concrete	0	\$0.00	\$0.00
Porous asphalt	0	\$0.00	\$0.00
Reinforced turf	0	\$0.00	\$0.00
Total		\$1,340,555.55	\$164,027.33

Master Planners are to "save as .pdf or .jpeg and attach" each Army LID Planning and Cost Tool Report to the project DD1391, Tab J.

APPENDIX B

Example. LID BMP Strategy and TAB J, Storm Drainage/Low Impact Development

1. **LID BMP Strategy (pre-Planning Charrette (PC)).** The "pre-PC" LID BMP Strategy is a listing of "Types" and "Quantities of LID BMPs" planned for incorporation in the project and is a reflection of the LID Planning and Cost Tool Report (see Appendix A). The pre-PC BMP Strategy is entered in the Text Box at Tab J, Storm Drainage/Low Impact Development. The following is an example BMP Strategy.

LID 1. Install 3,000 SF of bioretention across parking lot to include tree planting to reduce heat island effect. Plan for runoff sheet flow to bioretention with water storage system (w/under drain).

LID 2. Give strong consideration to enhanced bioretention (placing two or more BMPs in series) as water temperature and sediment are water quality concerns (see State TMDLs for installation).

LID 3. Construct 2,000 SF of bioretention rain gardens along west edge of LOD and at two opposing corners of the building (strong consideration to be given to Southeast and Northwest corners as they have good slope and Northwest corner also has existing storm water pipe to tie BMP overflow to as necessary).

LID 4. Use 3,000 SF of drainage swale on Southwest and Northeast corners of project as they have natural drainage from the site.

LID 5. Install 2,000 SF of infiltration trench along north edge of parking lot.

LID 6. Install 20,000 SF of permeable pavers across parking lot and walkways.

LID 7. Install 15,000 SF of green roof on the building. (NOTE: The green roof is not included in the "LID Cost Summary" table, Appendix A. The "Tool" is not able to calculate the cost of a green roof due to the many variables that come into play in the planning and design process. The Master Planner is required to develop an estimated cost).

APPENDIX B

Example. The LID BMP Strategy and TAB J, Storm Drainage/Low Impact Development (Cont.)

2. LID BMP Strategy (Post-PC). The "post-PC" LID BMP Strategy is a refined listing of "Types" and "Quantities of LID BMPs" planned for incorporation in the project and entered in the Text Box at Tab J, Storm Drainage/Low Impact Development. The following is an example of a refined BMP Strategy and provided in the Text Box. This LID BMP Strategy goes forward to the PDR/3086 process.

LID 1. Construct 4 - 100 ft. long bio-retention BMPs parallel to one another in the parking lot. Bio-retention is to have a 6ft W X 4ft D cross-sectional area and utilize parking lot slope to flow stormwater into the BMPs. Do not install curb that impedes sheet flow to BMPs. BMP area is 4 X 6' X 100' = 2,400 SF. Plant eight (8) White Oak trees in parking lot BMPs not closer than 80 feet to one another.

LID 2. Construct 2,600 SF of bioretention rain gardens along west edge of LOD and at Southeast corner of building. Tie underdrain to existing storm water pipe.

LID 3. Install 3,000 SF of drainage swale on Southwest and Northeast corners of building site.

LID 4. Incorporate 2,000 SF of Infiltration trench adjacent to the Northeast corner of building site and tie over to the Northwest corner of the parking lot. Do not direct parking lot drainage to filter trench.

LID 5. Install 20,000 SF of permeable pavers. Make all walkways with pavers. Remaining square footage required to meet 20,000 SF to be made up around the parking lot. Provide runoff storage within base material.

LID 6. Install a 15,000 SF low maintenance green roof along the western sloping roof line. If this BMP turns out to be infeasible, review design data and increase bioretention as necessary to meet EISA.

APPENDIX C

Example. DD1391, Tab A Cost Estimates for LID BMPs

Develop LID Cost Estimate at Planning Charrette. Use the LID Cost Planning Tool to develop a cost estimate for each planned LID BMP type in the Tab J, Text Box (LID BMP Strategy) and enter into Tab A Cost Estimate, Supporting Facilities Section. Input to Tab A may vary but should be developed using nomenclature similar to the following:

Storm Drainage Description	UM	Quan	UC(\$)	Total (\$)
LID 1 Bioretention	SF	2,400	\$36.00	\$86,400
W/Oak Trees	EA	8	\$400.00	\$3,200
LID 2 Bioretention	SF	2,600	\$36.00	\$93,600
LID 3 Drainage Swale	SF	3,000	\$11.00	\$33,000
LID 4 Infiltration Trench	SF	2,000	\$82.00	\$164,000
LID 5 Permeable Pavers	SF	20,000	\$48.00	\$960,000
LID 6 Green Roof*	SF	15,000	\$98.67	\$1,480,050

* Cost is an estimate and not based on real data.

Notes:

- Changes to the BMP strategy may take place along the way through project development. These changes may take place during the project definition report (PDR) (Code 3) and the Design (Code 6/7). In all instances installation/activity Master Planners are to be coordinated with planned changes. The Designer of Record uses the information in the DD1391 as the starting point to identify installation Master Planner supported LID BMPs that meet Army Policy and Guidance.
- A PDR consists of a 1391 scope validation resulting in a refined scope of work and a completed ENG Form 3086 cost estimate. LID BMPs identified in Tab J are refined during the PDR process and updated in the PDR and ENG Form 3086.

APPENDIX D

Example. Input to LID Module, Army Energy and Water Reporting System

1. Description. The enclosed metrics may be recorded for each LID BMP constructed.
2. Installation/Activity.
 - a. SUID:
 - b. Installation/Activity Name
 - c. Sub Installation/Activity Name
 - d. Land Holding Command Name
 - e. Sub Command Name
3. Administrative Details.
 - a. Project Number: (DD1391, DA4283, other)
 - b. From Date: (Same as Project Completion Date from HQIIS)
 - c. Project Funding Source (MILCON, OMA, etc.)
 - d. Project Name
 - e. Project Description
 - f. Project Address
 - g. GPS Coordinates for Center of Overall Project: (from Google Earth)
4. Project Planners and Designers.
 - a. Master Planner Name
 - (1) Phone Number (Commercial)
 - (2) Email
 - b. USACE Geographic District Name
 - c. USACE or AE Project Manager Name
 - (1) Phone Number (Commercial)
 - (2) Email
 - d. USACE or AE LID Designer of Record Name
 - (1) Phone Number (Commercial)
 - (2) Email
5. Site Conditions.
 - a. Limit of Disturbance (Acres)
 - b. Pre-Project Curve Number
 - c. Post Project Curve Number
 - d. 95th Percentile Storm Event (inches of rain)
 - e. Pre Project Runoff Volume (ft3)
 - f. Post Project Runoff Volume (ft3)

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Example. Input to LID Module, Army Energy and Water Reporting System (Cont.)

- g. Volume required to be retained on-site (ft³) (difference in Pre and Post Runoff)
- h. LID BMP Capacity Constructed (ft³)
- i. Does Project Comply with EISA (If No, provide justification and submit Infeasibility Report)
- j. Reduction in Impervious Surface Area (SF)

6. BMPs Constructed.

Description	BMP Centroid (northings, eastings)	Impervious Surface Area Treated (SF)	Volume of Runoff Retained (CF)	BMP Cost (\$)
a. LID 1 ...				
b. LID 2 ...				
c. LID 3 ...				
d. Etc.				

7. Other Stormwater Regulatory Requirements.

- a. Name of State and/or Local Stormwater Management Regulatory Authority
- b. Is installation/Activity required to meet Total Maximum Daily Loads?
- c. Pollutants and Limits Listed in TMDL Permit
- d. Name of Regulatory Authority

8. Infeasibility.

- a. If project does not fully comply with EISA, GC provides: all site constraints that prevent the project from full compliance (e.g. engineering calculations, soil data, hydrologic analyses, geotechnical considerations, local water restrictions, etc.) through the Chain of Command to Director, Operations Directorate, Office of the Assistant Chief of Staff for Installation Management, Attn: DAIM-ODC, 600 Army Pentagon, Washington, DC 20310
- b. Date Garrison CDR Mailed Infeasibility Data to respective LHC.
- c. Date LHC Mailed Infeasibility Data to DAIM-OD.
- d. Date OD Provides Infeasibility Data and recommendation to ODASA(IH&P).
- e. DASA(IH&P) approves/disapproves Infeasibility Submission.