CENAO-RG

U.S. Army Corps
Of Engineers
Norfolk District

Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

August 10, 2006

Public Notice Seeking Public Comment on a Revised Proposed Requirement Relative to Low Impact Development

On July 22, 2004, we issued a public notice seeking public comment on a proposal to require consideration of Low Impact Development (LID) practices in the review of development projects.

In response to the public notice, we received numerous comments. Since then, we have met with many of the commenting parties to discuss their concerns. From those discussions, we have made numerous changes to our original proposal. We also made a commitment to re-advertise our revised proposal to provide any opportunity for the public to comment. Enclosed please find our revised proposal with the additions in bold text and the deletions in strikeout.

Comment Period: Comments on this revised proposed requirement should be made in writing and addressed to the Norfolk District, Corps of Engineers (ATTN: Bruce F. Williams) at 803 Front Street, Norfolk, Virginia. 23510-1096 or by email to bruce.f.williams@usace.army.mil. If you have any questions, you may call Mr. Williams at 757.201.7418. All comments should be received by the close of business on September 11, 2006.

J. Robert Hume, III
Chief, Regulatory Branch

How and When the Norfolk District Corps of Engineers Will Consider Low Impact Development Practices in the Review of Permit Applications for Commercial and Institutional Development

The Corps of Engineers is responsible for administering Section 404 of the Clean Water Act. Permits are required from the Corps for proposed discharges of dredged and/or fill material into waters of the United States, including wetlands. We are required by the Environmental Protection Agency's Section 404(b)(1) guidelines to only issue a permit for the least environmentally damaging practicable alternative. Practicable includes consideration of cost, logistics, and existing technology. As part of our evaluation, we ensure that development projects are designed to minimize their impacts on waters and wetlands. ~~We strongly encourage that impacts to waters and wetlands be avoided through locating stormwater management facilities outside of waters and wetlands. A potential alternative to traditional stormwater management practices is the use of Low Impact Development (LID) practices. The Norfolk District is a member of a workgroup composed of local, State, and Federal agencies and development and environmental interests that has been examining how to encourage the use of low impact development (LID) practices while creating a review process that is predictable and timely for the regulated public.~~

Stormwater management is an important component of any commercial or institutional development. Conventional stormwater management seeks to attenuate flood peaks and treat for stormwater pollutants such as phosphorus, nitrogen, and silt (sediment). Oftentimes, this goal is achieved through the construction of stormwater management ponds in waters and wetlands. Conventional stormwater management ponds typically detain some of the increased volume of water caused by increased impervious surfaces and release it at a lower rate. Stormwater management **facilities** are primarily designed to control peak discharge rates for certain storm events. However, a greater volume of runoff is released for a longer duration. The **stormwater management facilities** associated with many conventionally designed developments may adversely affect waters and wetlands both upstream and downstream through filling and backflooding.

LID practices (and design strategies) attempt to minimize impervious cover, conserve natural cover, and to replicate the pre-development runoff volume and timing, and replicate the pre-development runoff rate (volume, timing, and rate) which are the three primary elements of a natural hydrograph. These goals may be achieved through the use of such options as permeable surfaces for parking areas, residential lot setbacks, minimizing roadway widths where possible (taking into account fire and emergency vehicle access requirements), narrower sidewalks, selective clearing, flattening grades, disconnecting impervious surfaces, infiltration practices, amended soils, open, vegetated swales, and distributed versus concentrated runoff (maintaining natural runoff patterns).

In its review of proposed commercial and institutional developments involving stormwater management facilities located in waters and/or wetlands, the Norfolk District will first request project proponents to review alternatives to avoid such impacts. If those impacts can be avoided, the proponent will not be requested to conduct any additional analysis. However, if the proponent of a commercial or institutional development decides not to avoid all impacts to waters and/or wetlands caused by the stormwater management facilities, the Norfolk District will request them to evaluate the practicability of incorporating LID practices to further minimize the impacts as outlined below.

<u>How</u> Low Impact Development Practices Are Being Evaluated

~~If a proponent can design development so that all stormwater management ponds are located outside of waters and wetlands, then they will not need to evaluate the practicability of LID practices. However, if stormwater management facilities are proposed in waters and wetlands, the Norfolk District would require applicants to evaluate LID practices as an alternative for all commercial and institutional developments. and residential developments that involve high density, multi-family development projects (apartments and condominiums) but not attached (townhouses) or detached residential construction. The enclosed Site Design Checklist and LID Calculations Worksheet will assist applicants in conducting this evaluation.~~

In establishing such a requirement to consider LID in project design, we acknowledge that LID is not practicable for all sites. Our regulations recognize that for an alternative to be practicable it has to achieve the purpose of the project, be available to an applicant, and be feasible considering cost, logistics, and existing technology. Examples of circumstances when the use of LID practices would not be practicable and the **enclosed Site Design C**hecklist and **LID Calculations W**orksheet would <u>not</u> need to be submitted are as follows:

> -projects that do not propose construction of stormwater management ponds in waters or wetlands (We do not propose to change how we review stormwater outfalls **or existing stormwater facilities**.)
>
> -regions or project sites with soils that are prohibitive to the use of infiltration practices. This would include soil ~~textures with a less than 0.52 inch per hour infiltration rate.~~ **defined in county soil surveys as somewhat poorly drained to poorly drained for crops and pasture and/or the local hydric soils list.** These are soils in the Hydrologic Soil Groups C and D (silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay loam, silty clay and clay).
>
> -regions or project sites with high water tables or Karst topography;
>
> -regions or project sites where opposition to the use of such practices is expressed by the governing locality; and
>
> -for project sites where the use of distributed LID practices is incompatible with the use or development proposed, or State/local land use planning and zoning requirements.

We believe the above clearly outlines when LID practices need to be considered. However, in cases when **off-line stormwater management facilities are not practicable or** LID is not considered practicable, ~~or the project proponent chooses not to pursue it as an alternative for stormwater management,~~ **and impacts to waters and/or wetlands will still occur**, our regulations ~~still~~ require **compensatory mitigation for** all **unavoidable** impacts to waters and wetlands**.**

Maintenance requirements and inspection frequencies are outlined in Commonwealth of Virginia's 2001 Stormwater Management Regulations (4VAC3-20). The responsibility of the required maintenance rests with the permittee **for the life of the permit** unless a transfer to another party is approved by the Norfolk District, Corps of Engineers. (Permits are transferable in whole or in part.)

With that in mind, the Norfolk District actively participates and remains committed to the preapplication consultation process. During preapplication consultations, the Norfolk District will strongly encourage that measures be incorporated into project plans that avoid and/or minimize impacts to waters and wetlands whenever and wherever practicable. We will be contacting localities to seek an opportunity to participate in their evaluation of preliminary plans. This will ensure that project proponents and the locality are aware of our comments early in the review process and that our comments are fully considered as the project design proceeds. Projects that do not incorporate all appropriate and practicable measures to avoid and minimize impacts and compensate for unavoidable impacts will not comply with our regulations or the Environmental Protection Agency's 404(b)(1) guidelines and will be denied.

This proposed requirement will not delay the issuance of a public notice for a permit application that is otherwise complete as outlined in 33 CFR 325.1(d).

Site Design Checklist
and
LID Calculations Worksheet

Draft Revision July 2006

INTRODUCTION

<u>This checklist and worksheet must be completed for those commercial and/or institutional developments with stormwater management facilities located in waters and/or wetlands. This analysis can be submitted with the permit application or during the preapplication consultation process.</u>

SECTION A: SITE DESIGN CHECKLIST

Prior to developing any structural stormwater practices on a site, significant reductions in stormwater quantity and quality impacts can be made through <u>enhancements to site design.</u> Below is a checklist of site design and planning practices that can be used to minimize stormwater impacts. Please check the practices that you are applying to your development, and note the extent to which each selected practices was implemented.

<u>Site Design Technique 1</u>:
Minimize direct stormwater impacts to streams and wetlands to the maximum extent practicable. This can be accomplished by locating stormwater facilities outside of streams and wetlands, maintaining natural drainages, and preserving riparian buffers.

1. Natural drainage routes maintained on site:

Describe actions taken:

2. Riparian buffers preserved.

Describe actions taken:

3. Distributed “Integrated Management Practices” used in lieu of centralized ponds.

Describe actions taken:

<u>Site Design Technique 2</u>:
Preserve the natural cover on as much of the site as possible, especially for areas located on hydrologic soil groups (HSG) A and B.
Natural vegetation helps maintain and preseve predevelopment hydrology on a site, thereby reducing the reliance on large-scale stormwater ponds. Natural cover on highly permeable soils increases filtration and infiltration.

1. Is there an opportunity to locate integrated management practices in common areas?

Describe actions taken:

2. Utilize “fingerprint” clearing, limit the clearing and grading of forests and native vegetation to the minimum area needed for the construction, the provision of necessary access, and fire protection.

Describe actions taken:

3. A & B Soils preserved in natural cover.

Describe actions taken:

Site Design Technique 3:
Minimize the overall impervious cover.
Roadways, sidewalks, driveways and parking areas are the greatest sources of site imperviousness. Impervious areas alter runoff and recharge values and site hydrology. For LID sites, managing the imperviousness contributed by road and parking area pavement is an important component of the site planning and design process. There are several methods that can be used to achieve a reduction in the total runoff volume from impervious surfaces.
Examples include width of streets and sidewalks, street layouts, cul-de-sac design, parking, setbacks and frontages, and minimizing compaction.

1. Utilize structured or shared parking

Describe actions taken:

2. Substitute pervious surfaces for impervious wherever practicable.

Describe actions taken:

3. Where permitted, avoid the use of curb and gutter. Utilize vegetated open swales, preferably “engineered swales” with a permeable soil.

Describe actions taken:

Site Design Technique 4:
Locate infiltration practices on HSG A and B soils wherever possible.

Are HSG A & B soils **on the site? If no, proceed to Site Design Technique #5.**

How you have HSG and B soils, how are they are being utilized?

Describe actions taken:

Site Design Technique 5:
Does the site contain Class C and D soils?

Yes No

If yes, proceed to Site Design Technique #6.

Site Design Technique 6:
"Disconnect" impervious areas.
"Disconnecting" means having impervious cover drain to pervious cover, i.e. downspouts draining to the yard, not the driveway. This decreases both the runoff volume and Time of Concentration. Disconnected parking lots, for example, can provide sheet flow into bioretention areas or engineered infiltration swales.

Describe actions taken:

Site Design Technique 7:
Increase the travel time of water off of the site (Time of Concentration)
Replicating the pre-development Time of Concentration is a key aspect in maintaining pre-development flow regime, and minimizing downstream impacts.

1. Flatten grades for stormwater conveyance to the minimum sufficient to allow positive drainage.

Describe actions taken:

2. Increase the travel time in vegetated swales by using more circuitous flow routes, rougher vegetation in swales, and check dams.

Describe actions taken:

3. Utilize "engineered" swales in lieu of pipes or hardened channels. These swales will have shallow grades and will have a sand or gravel substrate below the sod to promote infiltration.

Describe actions taken:

Site Design Technique 8:
Utilize soil management/enhancement techniques to increase soil absorption

1. Delineate soils on site for the preservation of infiltration capacity. Mark these areas in the field and restrict heavy equipment access.

Describe actions taken:

2. Require compacted soils in areas receiving sheetflow runoff (such as yards, downslope of downspouts) will be “disked” and amended with loam or sand prior to seeding/sodding.
Describe actions taken:

Site Design Technique 9:

Use “engineered swales” for conveyance in lieu of curbe and gutter wherever possible. Engineered swales utilize a sand substrate to maximize infiltration. Maintaining the predevelopment time of concentration (Tc) minimizes the increase of the peak runoff rate after development by lengthening flow paths and reducing the length of the runoff conveyance systems.

Describe actions taken:

Site Design Technique 10:

Utilize level spreading of flow into natural open space. Wherever buffers or other areas of open space are preserved, ensure that they are made hydrologically functional by making them receiving areas for sheet flow, not concentrated flow. Use level spreaders on lot or pavement edges to help spread water into the preserved areas. Ensure that flow volumes do not cause channelized flow and erosion in receiving buffers.

Describe actions taken:

Much of the above is excerpted from the Prince George's County, Md., 1999 *Low Impact Development Design Strategies: An Integrated Design Approach*. Largo, Maryland. (See References) All planned LID techniques should conform to the designs of those presented in this manual. Descriptions of the above and other site design techniques can be found in the LID references listed in aforementioned manual.

SECTION B: LID Calculations Worksheet

Definitions

Low Impact Development (LID) – **LID is a design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic landscape. Hydrologic functions of storage, infiltration and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale stormwater retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoffs time. Other strategies include the preservation/ protection of environmentally sensitive site features such as riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, and highly permeable soils.**

Detention – The collection of runoff in a ponding area, depression, or storage chamber followed by its gradual release through an outlet into a receiving water body. Detention is one way to reduce a site's peak runoff rate to its pre-development peak rate for the storm event of a given magnitude, but is not an effective way to reduce the runoff volume.

Retention – The collection of runoff in a ponding area or receptacle where it is kept until it soaks into the ground through infiltration. Retention reduces the volume of runoff from a site and can also be effective in reducing the peak runoff rate if the retention volume is sufficiently large.

Time of Concentration (Tc) – The time for runoff to travel from the hydraulically most distant point of the development site to the watershed outlet or study point.

Instructions

Before beginning the LID Calculations Worksheet, **first evaluate your site design using the Site Design Checklist**. The use of the site design practices is a critical component in ensuring that the pre-development hydrology on a site can be maintained.

The following worksheet follows the process detailed in *LID Hydrologic Analysis* (see references). Designers should download a copy from the internet to assist in the completion of this worksheet.

Note: Development projects that are unable to create sufficient retention practices to maintain the predevelopment runoff volume should revisit the application of the site design practices to the site. The thorough use of site design practices will reduce post-development curve numbers, and can result in decreased stormwater detention and retention volume requirements. Additionally, modifications to the design of bioretention practices, such as the inclusion of a gravel sump, can provide additional storage volume).

Determining the LID Runoff Curve Number

(LID Hydrologic Analysis, pg 22-25)

a. Calculate pre-development Curve Number (CN) and Time of Concentration (Tc) using TR-55 or other suitable method.

CN_{pre} = ________
Tc_{pre} = _______ minutes

b. For comparison purposes, calculate a composite curve number for the *developed site*, using the **conventional TR-55 approach**.

$CN_{conventional}$ = ________

c. Calculate a composite **custom LID curve number** for the site, following the approach in Section 4.3 (pages 22-24) of "LID Hydrologic Analysis*". *This is much more detailed than the conventional Tr-55 approach.* This approach factors in the use of higher permeability soils for infiltration and the use of "disconnectedness" (impervious cover flowing to pervious cover). Use an R factor of "1" for bioretention practices.

$CN_{conventional}$ = _______ (from above)
CN_{LID} = ________

Reduction in CN achieved with site design = _______ ($CN_{conventional}$ - CN_{LID})

d. Calculate the post-development Time of Concentration (Tc). Utilize the practices described in "LID Design Strategies"*, such as flattening grades, lengthening flow paths, etc to reduce the Tc to the predevelopment time.

Tc_{pre} = _______
Tc_{LID} = _______ (the Tc after maximizing practices to lengthen flow travel time)

NOTE: For the LID approach to function effectively, the Tc_{pre} must equal Tc_{LID}.
If Tc_{LID} is higher, <u>STOP here</u> and incorporate practices to reduce it.
See "LID Design Strategies" for details.

Step 1: Determine the Retention Volume Required to Maintain Pre-development Runoff Volume

a. Calculate the **Design Rainfall** for your site, per the procedure outlined on pages 36-38 of "LID Hydrologic Analysis*". This is the rainfall at which runoff would have initiated on the site, if it were vegetated with "woods in good condition".

If your calculated value for Design Rainfall is LESS THAN the 1-year 24 hour rainfall for your area, **USE the 1-year 24 hour rainfall instead.**

Design Rainfall = ______ in

b. Use the tables in Appendix A of the "LID Hydrologic Analysis*" to calculate inches of storage volume to **Maintain Predevelopment <u>Runoff Volume</u>** ***for your Design Rainfall***

Preliminary Retention Storage volume = _____ $in_{across\ entire\ site}$ = ______ ft^3

Step 2: Determine Storage Volume for Water Quality Protection

a. Per example 4.3, ensure that the Preliminary Retention Storage Volume (Step 1.b) meets or exceeds the **"Water Quality Volume",** which is ½" or runoff from impervious areas on the site.

Preliminary Retention Storage Volume = ______ ft^3 (From Step 1.b) Water Quality Volume = ______ ft^3	Enter Higher → → → → Value	Retention Storage Volume = _________ ft^3

b. Following example 4.2 on page 29 of "LID Hydrologic Analysis*", **calculate the area of IMP's required** to be distributed evenly on the site to retain the Retention Storage Volume.

Bioretention Design Option	Area ft^2	% of site
6" ponding depth		
6" ponding depth + 12" gravel sump (= 10.8" total storage)		
8" ponding depth		
8" ponding depth + 12" gravel sump (= 12.8" total storage)		
8" ponding depth + 18" gravel sump (= 15.2" total storage)		
10" ponding depth + 18" gravel sump (= 17.2" total storage)		

*Gravel sump storage estimates assume #57 stone with 40% void space

Step 3: Determine the Storage Volume for Maintaining Peak Runoff Rate

Using the Charts in Appendix B of the "LID Hydrologic Analysis", determine the **storage volume** required to **maintain peak Runoff Rate using 100% RETENTION storage.** **(Use the chart for a Type II storm for with your design rainfall)**

Storage Volume $_{\text{Peak Rate Control}}$ *(using 100% Retention)* = ________ in (across entire site)
= ________ ft^3

Step 4: Evaluate Need for Additional Detention Storage (Hybrid Design)

Compare the volumes required for volume control and peak rate control:

If Retention Storage *Volume > Storage Volume$_{\text{peak rate control (100\% Retention)}}$…*
Design site IMPs to retain (infiltrate) the Retention Storage Volume. No additional detention is required.

If Retention Storage Volume < *Storage Volume$_{\text{peak rate control (100\% Retention)}}$…*
*(or if **Retention Storage Volume** is unachievable with infiltration IMPs due to site **constraints**) then a HYBRID DESIGN IS REQUIRED.*
Follow Steps 5,6, & 7 on pages 34-37, of "LID Hydrologic Analysis" to calculate additional detention or retention required to meet peak runoff rate.
LID seeks to use distributed, micro-scale practices such as rain gardens, amended soils, green roofs, rain barrels, etc to retain this additional volume as well. If this is not practicable for the site, ponds can be used to detain the additional volume.

Additional detention required = ______ in (across entire site)
= ______ ft^3

Summary of Quantitative LID Results

Yes / No Site design and impervious cover reduction practices were used to the maximum extent practicable to minimize runoff volume.
Yes / No The design results in a post-development Tc equal to the pre-development Tc.
Yes / No The entire **Retention Storage Volume** will be retained and infiltrated.
Yes / No / NA If the entire **Retention Storage Volume** is not retained and infiltrated, the plans show that every practicable effort was made to implement runoff volume reduction efforts, and all potential green space areas were made hydrologically functional for retention.
Yes / No Detention practices were used to store any additional volume required to maintain the predevelopment peak rate.

References

1. ***Model Development Principles for the Central Rappahannock*** is available for download at http://for.communitypoint.org/pages/download.htm
2. **Low Impact Development National Manual. *Low-Impact Development Design Strategies An Integrated Design Approach.*** EPA 841-B-00-003. Available on the web at http://www.epa.gov/owow/nps/urban.html and via FTP at ftp://lowimpactdevelopment.org/pub/
3. **Low Impact Development National Hydrology Manual. *Low-Impact Development Hydrologic Analysis*.** EPA 841-B-00-002**.** Available on the web at http://www.epa.gov/owow/nps/urban.html and via FTP at ftp://lowimpactdevelopment.org/pub/
NOTE: The appendices to the hydrology document include a series of charts which are required to calculate LID storage volumes. They are not currently available in the downloadable version, but selected charts from that series are attached to the end of this document.

Storage Required to Maintain Pre-Development Peak Runoff Rate Using 100% Detention (hundredths of an inch)