Stormwater Criteria for Maryland Critical Area IDA Zone

Appendix D.4

This Appendix has been adapted from the document

> Urban Stormwater Quality Guidance for the
> Maryland Chesapeake Bay Critical Area
> in Intensely Developed Areas
>
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Additional Information on the 10% Rate, including an applicants guide, can be obtained from the:

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Background

What is the Critical Area?

The Chesapeake Bay Critical Area Act, passed by the Maryland General Assembly in 1984, is designed to help protect the Chesapeake Bay and its tributaries from resource degradation primarily resulting from development activity. In 1986, the more specific and comprehensive Critical Area Criteria were adopted to implement the law. **The "Critical Area" is defined as all water and submerged lands of the Chesapeake Bay to the head of tide, and all land and water within 1000 feet of Mean High Water or from the edge of tidal wetlands.** The Criteria mandate certain restrictions on the use of land within this area. However, the responsibility for implementing the Criteria is delegated to local governments, where zoning and other land use controls have traditionally been carried out.

What is an IDA?

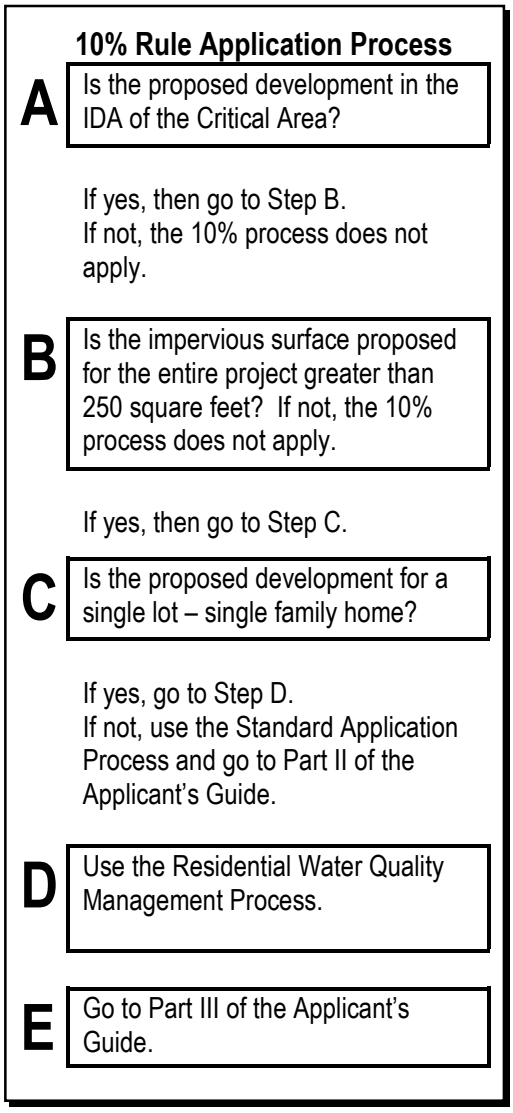
In writing the Criteria, the Chesapeake Bay Critical Area Commission was cognizant of the fact that development already existed within the Critical Area. The Criteria also written with an implicit acceptance of a limited and controlled level of additional development or redevelopment. One particular class of land use, termed **"Intensely Developed Areas,"** or **IDAs**, was identified as areas where continued growth could be accommodated through redevelopment and/or new development. Local governments desiring to permit or promote such projects within the Critical Area have been encouraged to direct such efforts within the IDA.

What does the 10% Rule mean?

IDAs are designated to each local jurisdiction and are characterized as intensely developed areas that are predominately commercial, residential or industrial in nature. The Critical Area Criteria require that any development within the IDA be accompanied by urban **"best management practices (BMPs)"** to help mitigate potential water quality impacts associated with stormwater runoff. The Criteria further specify that these practices should be capable of removing pollutant loads generated from the development site to a level at least 10% below the load generated at the site prior to development. This requirement is commonly referred to as the **"10% Rule."**

Introduction

The requirements set forth in this document relate only to the requirements of the Chesapeake Bay Critical Area Act passed by the Maryland General Assembly in 1984 as well as the associated criteria passed in 1986. Under this act, development and redevelopment activities shall be required to use stormwater management practices appropriate to site development which achieves a ten (10%) percent reduction of pre-development pollutant loadings.



This section details a step-by-step approach for compliance with the 10% Rule. It is important to note that these requirements are designed to provide water quality treatment of urban runoff and that other site environmental features cannot be substituted towards compliance. For example, environment requirements for waste water treatment plants cannot be substituted for urban runoff BMPs— the Six Step Standard Application process or Standard Procedure.

Two application processes have been developed for 10% Rule compliance in recognition of the broad scale of development that occurs within the Critical Area.

- In the Standard Procedure, computations of pre- and post-development pollutant loadings and pollutant removal efficiencies of BMPs are used to determine compliance with the 10% Rule.

- The second procedure provides a streamlined process for individual, residential lot development. If the proposed development is eligible, the applicant must submit a Residential Water Quality Management Plan for approval.

The 10% Rule provides three different approaches for compliance:

1) A reduction in impervious surface may lower post-development levels; therefore, I_{post} is lower, and hence, I_{post} (post-development load) is lower;

2) A stormwater management BMP may remove pollutants from the Critical Area portion of the site equal to the 10% reduction;
3) A stormwater management BMP may remove pollutants from the Critical Area portion of the site and portions outside of the Critical Area equal to the 10% reduction.

Who must comply?

An individual planning development or re-development of land in the Critical Area District zoned as an Intensely Developed Area (IDA) must comply with the 10% Rule. As mentioned above, IDA refers to the land-use management classification as determined by the Chesapeake Bay Critical Area Commission and incorporated into a local government's Critical Area program. IDAs are areas where residential, commercial, institutional, and/or industrial developed land uses predominate, and where relatively little natural habitat occurs. IDAs also have at least one of the following characteristics:

- A density of development equal to or greater than four dwellings per acre;
- Presence of public water and sewer systems with a density of greater than three units per acre; or,
- Concentration of industrial, commercial, or institutional uses. In addition, these features are concentrated in an area of at least 30 adjacent acres.

What must be submitted?

For persons proposing development or re-development in areas designated as an IDA on a local Critical Area map, the specific submittal requirements vary from jurisdiction to jurisdiction. Applicants should refer to their local Critical Area Program guidelines for preliminary and final site plan or subdivision plan submittal requirements. As mentioned earlier, this Applicant's Guide contains the minimum recommended submittal requirements for two separate 10% Rule application processes. Schedules for submittal of either document may vary among Critical Area jurisdictions.

What if my project is small?

Check to see if the project meets the criteria for the Residential Water Quality Management Plan. This program is designed to ease the application process for individual lot residential development or improvements that involve disturbances of 250 square feet or greater. Projects smaller than 250 square feet of disturbance are exempted from the requirements of 10% Rule.

What if my project will be completed in phases?

Applicants anticipating that their development will occur in phases are required to submit a conceptual plan indicating the entire scope of work for preliminary review and approval. This will ensure that the impacts of the project are evaluated in their entirety.

Who do I submit it to?

Before commencement of construction, all plans indicating proposed development, (e.g. site plans, building permits, subdivision plans), shall be submitted to the county or municipality department which is generally responsible for the administration and enforcement of Chesapeake Bay Critical Area Program regulations. In most jurisdictions, there is a zoning department that handles Critical Area projects.

How does this program relate to other stormwater management programs?

Other local or state stormwater regulations may require additional stormwater requirements or submittal information. For example, the state stormwater requirements require that stormwater designs be assessed according to the state priorities, (for example: infiltration of runoff as top priority, followed by wet ponds, etc.). State or local stormwater requirements may also specify control of larger storms for quantity or flood safety control purposes. It is possible to meet various design requirements within one facility, but local and state programs must be addressed in addition to the requirements outlined within this document.

When must the application be submitted?

Any application process for the 10% Rule should parallel the plan review process, for example: a conceptual 10% Rule Application should be submitted as part of the preliminary review followed by a final 10% application at the final plan review stage. Upon receipt of the site plan, the local reviewing agency may conduct a review soliciting technical comments from other departments, agencies, and officials. Although the process varies between jurisdictions, the site plan shall be preliminarily approved, subject to final approval, assuming it meets all requirements.

The Standard Application Process provides a six-step method for comparing pollutant loads before and after development, and assessing the appropriate BMP for a given site. The pollutant loading methodology is based on relationships between surface imperviousness and concentrations of pollutants found in urban runoff (Schueler 1987).

Table D.4.1 Six Step Method of the Standard Application Process

Worksheet A	
STEP #1	Calculate Site Imperviousness
STEP #2	Calculate Pre-Development Pollutant Load
STEP #3	Calculate Post-Development Pollutant Load
STEP #4	Calculate Pollutant Removal Requirement
STEP #5	Identify Feasible Urban BMP
Worksheet B	
STEP #6	Define Off-Site Compliance
then..	Submit Application to Critical Area Plan Reviewer

STEP 1: Calculate Site Imperviousness

In this step, the applicant will describe imperviousness of pre- and post- development site conditions. In general, impervious surfaces are human-made surfaces that are devoid of vegetation. Refer to Table D.4.2 for detailed definitions of imperviousness.

Impervious Measurement

- Imperviousness must be measured directly from the most recent site plan.
- A table of measured values (planimeter, preferred) listed specifically for each impervious surface type (roads, rooftops, etc.) must be submitted.
- Estimates of imperviousness based on land use types by computer generated surface runoff programs (e.g. TR-55), are not appropriate for submission.
- If land is subdivided prior to construction, it is recommended that a 10% Application is submitted at the time of initial subdivision, with imperviousness calculated using maximum building envelopes and proposed road layouts. This submittal process is recommended so that the entire project may be assessed as a whole.

Define Development Category

Using existing site imperviousness data, the proposed development must be categorized as 1) new development, 2) redevelopment, or 3) single lot residential.

1) New Development: pre-development imperviousness < 15%

2) Re-development: pre-development imperviousness > 15%

3) Single Lot Residential: projects involving an individual lot of residential development which exceed 250 square feet in site disturbance.

Table D.4.2 Definition of Imperviousness

Impervious Surfaces are those that:

1) impede the natural infiltration of rainfall into underlying soils; and,

2) result in an increased volume of surface runoff to adjacent soils. As a simple rule, human-made surfaces that are not vegetated will be considered impervious (BMPs will be exempted from this definition).

Surface	Impervious	Design Suggestions
Roads		
paved/concrete	yes	• minimize road width
gravel	yes	• avoid curb and gutters; use grassed swales
dirt	yes	
Driveways		
paved/concrete	yes	• minimize surface area
gravel	yes	• use gridded pavers or porous pavement in areas of low usage
dirt	yes	
grid pavers	no	
porous pavement	yes	
Sidewalks/paths		
paved	yes	• minimize surface area
gravel	yes	• disconnect imperviousness; combine with vegetation
grid pavers	no	
porous pavement	no	
wood chip	no	
Rooftops	yes	• use sheet-flow spouting, dry wells or french drains
Decks	yes	• treat runoff under deck area
Swimming pools/ponds	yes	

STEP 2: Calculate Pre-Development Pollutant Load

In this step the applicant calculates the storm loadings of phosphorous from the site prior to development (see Technical Guide "Simple Method for Calculating Phosphorous Export"). The equation shown in Table D.4.3 is a simplification of the equations presented in the 1987 10% Document. Two loading formulas are used based on the development category (redevelopment or new development) and site imperviousness. The information needed for these calculations include:

- the area of the site within the IDA of the Critical Area
- pre-development site imperviousness.

Table D.4.3 Method for Calculating Pre-Development Phosphorous Loading

Pre-development Phosphorous Loading: $L_{pre} = (R_v)(C)(A)\ 8.16$

$R_v = 0.05 + 0.009(I)$

where:

L_{pre}	=	average annual load of total phosphorous exported from the site in pounds per year
R_v	=	runoff coefficient, which expresses the fraction of rainfall which is converted into runoff
C	=	flow-weighted mean concentration of phosphorous in urban runoff (mg/l)
		C = 0.26 if pre-development I < 20%
		C = 1.08 if pre-development I ≥ 20%
A	=	area of the site within the IDA Critical Area (acres)
8.16	=	includes regional constants and unit conversion factors
I	=	site imperviousness (I = 75 if site is 75% impervious)

New Development Phosphorous Loading: $L_{pre} = 0.5\ (A)$

where:

L_{pre}	=	average annual load of total phosphorous exported from the site in pounds per year
A	=	area of the site within the IDA Critical Area (acres)

STEP 3: Calculate Post-Development Pollutant Load

The next step involves computing the post-development pollutant load from the site. Again, an abbreviated version of the Simple Method (Schueler, 1987), described in Step 2 is used for the calculations. The equations to be used to determined post-development pollutant loads follows below.

Table D.4.4 Method for Computing Post-Development Pollutant Loadings

Post-Development Pollutant Loading:		$L_{post} = (R_v)(C)(A)(8.16)$ $R_v = 0.05 + 0.009(I)$
where:		
L_{post}	=	average annual load of total phosphorous exported from the site through storm runoff in pounds per year
R_v	=	runoff coefficient, which expresses the fraction of rainfall which is converted into runoff
I	=	site imperviousness (I = 75 if site is 75% impervious)
C	=	flow-weighted mean concentration of the pollutant in urban runoff (mg/l) C = 0.26 if new development activity C = 1.08 if redevelopment activity
A	=	area of the development site (acres)
8.16	=	includes regional constants and unit conversion factors

STEP 4: Calculate the Pollutant Removal Requirement

Phosphorous pollutant loads generated from the site must be reduced so that they are 90% or less of the load that is generated prior to development. The amount of phosphorous that must be removed though the use of stormwater BMPs is called the Pollutant Removal Requirement. The equation in Table D.4.5 expresses this term numerically.

Table D.4.5 Computing Pollutant Removal Requirements

Removal Requirement	=	Post-development phosphorous load - (0.9) Pre-development phosphorous load $RR = L_{post} - 0.9\ (L_{pre})$

STEP 5: Identify Feasible Urban Best Management Practices (BMP)

Urban BMP options must be shown to be feasible for the site both in terms of physical suitability and pollutant removal capabilities (see Volume 1, Chapter 4). It should be noted that the BMPs which survive the screening procedure still need to undergo more detailed design checks and field tests to confirm that they are actually feasible. Evidence of site feasibility will be required as part of the final submittal package.

Table D.4.6 Estimate of Pollutant Load Removed by Each BMP

Load Removed = (Post-development Load)(Removal Rate)
$LR = L_{post}$ (RR)(% Drainage Area Served)

If the Load Removed is equal to or greater than the Pollutant Removal Requirement computed in STEP 4, then the on-site BMP complies with the 10% Rule. If not, the designer must evaluate alternative BMP designs to achieve higher removal efficiencies.

Tables D.4.7 and D.4.8 provide updated phosphorous removal rates for stormwater BMPs used in this manual, based on a comprehensive national survey of pollutant removal performance monitoring data (Brown and Schueler, 1997).

Table D.4.7 Updated Critical Area Keystone Phosphorous Removal Rates

CODE	BMP LIST	TP%
P-1	Micropool ED	40
P-2	Wet Pond	50
P-3	Wet ED Pond	60
P-4	Multiple Pond	65
P-5	Pocket Pond	50
W-1	Shallow Wetland	40
W-2	ED Wetland	40
W-3	Pond/Wetland	55
W-4	Pocket Wetland	40
I-1	Infiltration Trench	65
I-2	Infiltration Basin	65
F-1	Surface Sand Filter	50
F-2	Underground Sand Filter	50
F-3	Perimeter Sand Filter	50
F-4	Organic Filter	50
F-5	Pocket Sand Filter	40
F-6	Bioretention	50
O-1	Dry Swale	65
O-2	Wet Swale	40

Table D.4.8 TP Removal Rates for BMPs Not on the List

BMP LIST	TP%
Detention Facility - 2	10
Dry ED Pond - 7	20
Open Channels - 7	-15
Biofilter - 2	25
Dry Well	Nd
Catchbasin - 1	5
Filterstrip - 1	7
Water Quality Inlets - 1	0

Source: Brown and Schueler, 1997, National Pollutant Removal Database for Stormwater BMPs

STEP 6: Define Off-Site Compliance

In the event that on-site BMPs cannot fully meet the pollutant removal requirement and on-site design cannot be changed, an option exists for off-site mediation, otherwise known as an Offset Project. Of primary concern is that the project be associated with pollutant removal or water quality protection for water bodies within the same sub-watershed as the development project. Similarly, off-site projects should be designed to minimize maintenance requirements. In such cases where this is not feasilbe, a maintenance agreement should be established so as to insure long-term water quality protection. Table D.4.9 provides a prioritized list of potential offset projects.

Table D.4.9 Prioritized List of Potential Offsite Projects

Having shown that on-site compliance is not feasible, the applicant may choose from the following Offset options in order of preference.

1. Construction and operation of an off-site BMP, sized to meet the removal requirements.

2. Retrofit an existing BMP or pond structure.

3. Retrofit an existing storm drain system to encourage infiltration.

4. Reduce the imperviousness of an existing property through reforestation.

5. Implement a riparian reforestation project (0.5 acres of tree planting per lb of removal requirement). Planting plan must meet local Critical Area reforestation standards, or Maryland Forest Conservation Manual, if no local standards exist.

6. In rural jurisdictions where retrofit options are limited, finance the installation of a structural agricultural BMP for a farm with a NRCS approved conservation plan.

7. Other innovative options: restore a degraded tidal or non-tidal wetland that has been disturbed by previous urban or agricultural drainage activity. This may be accomplished through removal of fill, restoration of original water circulation patterns, and wetland plantings.