Comprehensive Environmental Inc.

APPENDIX A: STORMWATER TECHNICAL DESIGN CRITERIA

To Achieve Phase II Stormwater Compliance and Promote Low Impact Development

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Appendix A:

Stormwater Management Design Criteria

Table of Contents

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Stormwater Technical Design Criteria

Introduction

Why use design criteria at all? Early subdivisions and other developments were built with no protective design criteria at all – there were no design criteria – and when the land is cleared for development, runoff characteristics change dramatically for the worse. More runoff at higher velocities is discharged. The result of these developments was flooding, environmental damage, and economic losses where development became dense enough to affect people downstream.

In roughly the mid 1950s, engineers working for communities and design engineers for developments began using crude peak flow criteria such as designing for the 10-year storm. These criteria helped a little, but to a large degree just made people feel like they were controlling the impacts of development on flooding in particular. Storms smaller than the 10-year, which almost all of them are, passed untreated, undetained through the detention basins that were typically used to meet this minimal criteria. Larger storms also were not controlled.[1]

In the late 1980s and 1990s, stormwater quality became the focus of engineers and scientists trying to protect water quality. Many improvements were made in stormwater treatment, and proprietary units proliferated. The focus on quality improved the situation and added considerable costs to many projects, but also left the quantity side somewhat unregulated. Today, recognition of the quantity/quality link and the affects of stormwater losses on groundwater levels, streamflows and general dewatering of urban areas has brought the focus back to the quantity issue but with a different twist. Instead of trying to control only flooding, engineers are now trying to control smaller and smaller storms since over 90% of the runoff and its associated pollutant loads is in very small storms. A new recognition has also dawned that using peak criteria only results in sustained flows downstream – flows that over time cause significant channel and environmental damage.

Today, Low Impact Development or LID is the new buzzword, and many people are excited at the opportunity to better control the impacts of development that have become well recognized in the last 20 years. But there are no real design criteria to achieve LID, and without design criteria, the impacts of development will be difficult to control and most communities will have trouble identifying exactly what makes up LID and whether a development is actually going to achieve the best outcome possible.

[1] Note that stormwater management techniques that control small storms, recharge and other factors affect water quantity and quality significantly. Using peak discharge rates of 25, 50 and 100-year storms typically leaves the smaller storms untouched and addresses only the hydraulic impact of massive amounts of rain on downstream flooding, a somewhat rarer event.

Controlling the smallest storms and providing better, low impact development and drainage design has been done only rarely. Methods and data to measure its success are not yet perfected. So actually accomplishing LID will be slow and erratic, with potentially many more mistakes than successes until design criteria are established. This document is a working document meant to provide the first steps towards implementing better drainage design and Low Impact Development. Typically the use of these criteria will not add significantly to the cost of the development, but the long-term economic benefits to host communities could be substantial. Granted, developers and their engineers may not jump right into using the new criteria without encouragement -- no one likes change – but their use will help communities and designers provide better protection for abutters, the environment and the community's infrastructure.

These criteria update an earlier version of CEI's stormwater design criteria (CEI, 2002) to reflect recent improvements in methods to measure and control stormwater impacts[2]. In some cases, they provide more than one method to reach similar performance benchmarks, so that communities and design engineers can choose the best fit method for achieving the similar goals.[3] The criteria include:

1. **Stormwater Recharge**: an additional option has been added to the 1 inch infiltration found in CEI's 2002 criteria. The purpose is to address sites where soils are less conducive to infiltration while still providing hydrologic protection.

2. **Pretreatment**: more criteria for sizing pretreatment have been added to the 2002 criteria.

3. **Flood Protection**: More options are added to reflect the level of urbanization.

4. **Channel Protection**: this is a new criteria designed to protect downstream channels from the damage caused by sustained flows that would occur if only peak discharge was applied.

5. **Water Quality Volume:** Additional methods to compute water quality volume have been added. The purpose of this criteria is to ensure that stormwater runoff is treated, even if recharge is not an option.

6. **Erosion Control:** This is a new criteria from 2002, added because erosion control is crucial and an often overlooked or underutilized practice that may result in tons and tons of sediment released into waterways.

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[2] Some of CEI's 2002 criteria have been combined together where it made sense for simplification, and others have been modified to add more options for calculating the results. There are also three new criteria.

[3] Communities may choose to allow the use of any of the methods as alternates or may identify the one they are most comfortable with and allow only that method to be used. The criteria are listed from most conservative and protective of receiving waters to least conservative.

7. **Detention Basins:** This is a new criteria that if used will result in more naturalized detention basins being built, with better performance.

1. Stormwater Recharge[4]

Impervious and disturbed surfaces from development alter the natural hydrologic cycle by discharging stormwater directly to streams, rather than allowing it to infiltrate through the soils and into groundwater as it did before development. This increases flooding and reduces the baseflow to streams that is needed in the summer months when there is little precipitation. The increased runoff from impervious surfaces also increases stream temperatures, since pavement and other impervious surfaces absorb substantial amounts of heat in the summer due to their dark coloring and lack of shade, which is transferred to runoff passing over the surface. The result is runoff that is dramatically warmer than natural groundwater inflow would have been under a natural hydrologic cycle. The purpose of this criteria is to maintain existing recharge rates to preserve existing groundwater levels and stream baseflows. Two different methods to achieve better recharge are shown below. The first method is more conservative and protective of receiving waters than the second method.

<u>Method 1</u>

All storms up to 1-inch must be retained on site for post-development conditions. The volume of water to be retained can be calculated using the following equation:

Infiltration required per storm (ft^3) = impervious surfaces (ft^2) X 1.0 (inch) / 12 (inches per foot)

The following criteria also apply:

- Initial exfiltration during the design storm shall not be accounted for during the unit/device sizing, with the exception of roof runoff devices, which may account for exfiltration in sizing calculations.

- All units/devices shall be designed to drain within 48 hours from the end of the storm.

- Recharge shall not be concentrated to one area. It shall be distributed to multiple areas throughout the site.

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[4] The appropriate local review authority may alter or eliminate the recharge volume requirement if the site is situated on unsuitable soils (i.e., marine clays). In this situation the water quality volume must still be treated through other BMPs designed to remove pollutants. Underdrained soil filters using a highly organic material are the preferred alternative in these cases, as they most closely mimic the benefits of infiltration.

Redevelopment projects may not be able to achieve the one inch recharge criteria due to site layout and limited space. These projects must recharge or treat a minimum of one half inch of precipitation over the impervious surface.

- The recharge volume criteria does not apply to any portion of a site designated as a stormwater hotspot. Hotspots are defined as sites with higher potential pollutant loads, including:
    - Auto salvage yards (auto recycler facilities)
    - Auto fueling facilities (gas stations)
    - Fleet storage areas (cars, buses, trucks, public works)
    - Vehicle service and maintenance areas
    - Vehicle and equipment cleaning facilities
    - Commercial parking lots with average trip generation rates of 1,000 or greater per day, such as fast-food restaurants, convenience stores, high-turnover (chain) restaurants, shopping centers, and supermarkets
    - Road salt storage and loading areas (if exposed to rainfall)
    - Commercial nurseries
    - Flat metal (galvanized metal or copper) rooftops of industrial facilities
    - Outdoor storage and loading/unloading areas of hazardous substances
    - SARA 312 generators (if materials or containers are exposed to rainfall)
    - Marinas (service, repainting, and hull maintenance areas)

Method 2

The volume of water to be recharged shall be based on the site soils. The volume of water to be retained from the developed site should be calculated using the following equation:

$Re_v = [(S)(Rv)(A)(43{,}560)]/12$, *where*

Re_v = *recharge volume* (ft^3)

$R_v = 0.05 + 0.009(I)$ *where I is the percent impervious cover*

A = *site area in acres*

S = *Soil Specific Recharge Factor*

Hydrologic Group	*Soil Specific Recharge Factor*
A	*0.40*
B	*0.25*
C	*0.10*
D	*0.07*

The following criteria also apply:

- Initial exfiltration during the design storm shall not be accounted for during the unit/device sizing, with the exception of roof runoff devices, which may account for exfiltration in sizing calculations.

- All units/devices shall be designed to drain within 48 hours from the end of the storm.

- Recharge shall not be concentrated to one area. It shall be distributed to multiple areas throughout the site.

- The soil group classification used to determine the CN value shall be based on an on-site percolation test and the table below:

Soil Group	**A**	**B**	**C**	**D**
Infiltration rate when wet (inches/hour)	> 0.3	0.15 – 0.3	0.05 – 0.15	0 – 0.05

- If more than one soil type is present at the site, a composite soil specific recharge factor shall be computed based on the proportion of total site area within each soil type. The recharge volume provided at the site shall be directed to the most permeable soil available.

- The recharge volume criteria does not apply to any portion of a site designated as a stormwater hotspot. Hotspots are defined as sites with higher potential pollutant loads, including:

  - Auto salvage yards (auto recycler facilities)
  - Auto fueling facilities (gas stations)
  - Fleet storage areas (cars, buses, trucks, public works)
  - Vehicle service and maintenance areas
  - Vehicle and equipment cleaning facilities
  - Commercial parking lots with average trip generation rates of 1,000 or greater per day, such as fast-food restaurants, convenience stores, high-turnover (chain) restaurants, shopping centers, and supermarkets
  - Road salt storage and loading areas (if exposed to rainfall)
  - Commercial nurseries
  - Flat metal (galvanized metal or copper) rooftops of industrial facilities
  - Outdoor storage and loading/unloading areas of hazardous substances
  - SARA 312 generators (if materials or containers are exposed to rainfall)
  - Marinas (service, repainting, and hull maintenance areas)

2. Pretreatment

To prevent premature failure, the design of stormwater treatment devices shall include a pre-treatment device or method that will trap sand and sediments to avoid clogging the treatment mechanism. Infiltration of stormwater from the treatment device into underlying soils and eventually groundwater aquifers is an important beneficial component of the device. Pre-treatment basins must be designed and located to be easily inspected and accessible to facilitate maintenance. Pre-treatment devices must also be sized to accommodate a minimum of one-year's worth of sediment and debris.

The following standards shall be followed to ensure that the device will permit sufficient treatment to treat stormwater and allow for a reasonable required maintenance frequency for the BMP:

- Pre-treatment devices shall be provided for each BMP; ***and***

- Pre-treatment devices shall be designed to accommodate a minimum of one-year's worth of sediment; ***and***

- Pre-treatment devices shall be designed to capture anticipated pollutants, such as oil and grease; ***and***

- Pre-treatment devices shall be designed and located to be easily accessible to facilitate inspection and maintenance; ***and***

- The Revised Universal Soil Loss Equation (RUSLE)[5] shall be used to calculate sediment deposits that would occur from pervious areas adjacent to the BMP; ***and***

- Pretreatment structures shall be sized to hold an annual sediment loading. An annual sediment load shall be calculated using a sand application rate of 500[6] lbs/acre for sanding of roadways, parking areas and access drives within the subcatchment area, a sand density of 90 lbs per cubic foot and assuming a minimum frequency of ten sandings per year. To obtain an annual sediment volume, perform the following calculation:

  $$\textit{Area to be sanded (acres)} \times 500\ \frac{\textit{pounds}}{\textit{Acre-storm}} \div 90\ \frac{\textit{pounds}}{ft^3} \times 10\ \frac{\textit{storms}}{\textit{year}} = \frac{\textit{cubic feet of}}{\textit{sediment/yr}}$$

- The developer shall maintain any BMPs used to trap sediment during construction to prevent sediment from leaving the site, and shall remove all sediment from all BMPs when construction is finished and the site is stabilized.

Sanding rates and numbers of storms may need to be adjusted downward for southern New England and upward for northern New England.

3. Flooding Protection

Impervious and disturbed surfaces from development cause an increase in the volume, velocity and flowrates of stormwater leaving sites and entering surface waters. This in

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5 Developed by the Natural Resources Conservation Service, USDA to predict soil erosion to due water.
6 Municipalities may wish to adjust the sanding rate for roadways based on actual sanding rates for their Town or City. Sanding rates for private parking lots and facilities should assume the 500 lbs/acre.

turn causes flooding of the receiving waters during storms, which damages the streambanks. This can be controlled through the use of flow controls to prevent post-development peak discharges from exceeding pre-development peak discharges. It is important to control various size storms. Even the smaller storms warrant control as these occur more frequently and can be damaging to streambanks as the frequency and magnitude of flooding increases. Larger storms, such as the 100-year storm should also be controlled to prevent flood damage and maintain the 100-year flood plain boundaries.

The following standards should be followed to control peak discharge rates and improve the overall effectiveness of the BMPs. These are minimum design standards.

- The post-development peak discharge rate shall be equal to or less than the pre-development peak discharge rate (based on a 1-year, 2-year, 10-year, 25-year, 24-hour storm); ***and***

- Control the peak discharge rate from the 100-year storm to pre-development levels within the 100-year floodplain; ***and***

- The site shall be designed to ensure that all runoff from the site up to the maximum design storm (i.e., 100-year storm) enters the control structure. For example, the drainage system may only be sized to handle a ten-year storm, with larger storms flooding the distribution system and traveling overland. This overland flow, or overflow, must be directed into the peak control structure; ***and***

- The applicant shall account for all run-on and run-off (including off-site impacts) in both pre- and post-development conditions; ***and***

- The applicant shall prepare hydrographs for pre- and post-development conditions; ***and***

- The pre-developed condition shall be a forested land cover in good condition. Post development should assume a worst case condition (i.e., poor vegetated cover) for disturbed areas; ***and***

- Any site that was wooded within the last five years must be considered undisturbed woods for all pre-construction runoff conditions, regardless of clearing or cutting activities that may have occurred on the site during that pre-application period; ***and***

- Use TR-55 to develop hydrographs and peak flow rates for the proposed development site. Make sure all areas are accounted for in the pre/post runoff calculations. The total tributary area that contributes flow from the proposed site, including runoff entering the site through piped drainage or surface runoff from off-site sources, must be included even if a portion does not contribute flow to the BMP. The objective is for the development's storm drain design to account for total runoff leaving the site; ***and***

- Off-site areas should be modeled as "present land use condition" in good hydrologic condition for the 2 and 10-year storm events for both pre and post development calculations; ***and***

- The length of overland sheet flow used in t_c calculations shall be limited to no more than 50 feet for pre- and post-development conditions.

4. Channel Protection

Many storm water management practices focus on controlling peak flow rates for larger storms, including the 2-year, 10-year and 100-year storms. This does not address the increased duration at which those high flows occur because of the increased *volume* of water from development compared to pre-development. For example, although the peak flows are kept the same, there is a much greater volume of water leaving the site under developed conditions and the streams have higher flows for longer durations than they did under predevelopment conditions. In addition, because the impervious development has limited recharge, base flow during non-storm event times is lower. The purpose of this criterion is to limit the total amount of time that a receiving stream exceeds an erosion-causing threshold based on pre-developed conditions. Two methods to achieve better channel protection are shown below, with the more conservative and protective provided first.

Method 1
24 hours extended detention of the post-development 1-year, 24-hour return frequency storm event shall be provided.

Method 2
12 hours extended detention of the post-development 1-year, 24-hour return frequency storm event shall be provided.

5. Water Quality Volume[7]

Development also impacts the water quality of streams, ponds, lakes and wetlands. As impervious area increases, the volume and velocities of stormwater increase, often resulting in erosion of soils. Pollutant deposits on the land surface also increase as the intensity of land use increases. These materials are then washed off by rain and runoff, increasing the pollutant load to receiving waters. Thus, it is important that BMPs are used to handle water quantity as well as treat water quality. The water quality volume should include the first flush of storms, as this is where the majority of pollutants are collected and discharged. Two different methods for calculating water quality volumes are

[7] Redevelopment projects may not be able to treat the full water quality volume as estimated above due to site layout and limited space. These projects must treat a minimum of one half inch of precipitation over the impervious surface.

presented below. The first is more conservative and protective of receiving waters than the second.

Method 1

The water quality volume required to be treated shall be calculated as:

Water Quality Volume (ft^3)= $[(P)(R_v)(A)(43{,}560)]/12$, *where*

P = rainfall depth in inches – use 1"

$R_v = 0.05 + 0.009(I)$ *where I is the percent impervious cover*

A = site area in acres

- At a minimum use 0.2 inches per acre at sites with less than 15% impervious cover.

Method 2

The water quality volume required to be treated shall be calculated as:

Water Quality Volume (ft^3) = *impervious surfaces* (ft^2) *X 1.0 (inch) / 12 (inches per foot)*

6. Erosion Control

Land clearing and grading for construction purposes leaves soils susceptible to erosion. If not controlled, eroded soils may reach streams and lakes, filling them in and adding pollutants attached to the soil particles. It is important to have controls in place to prevent and control the erosion of disturbed lands. The following standards shall be met for erosion control:

- Prior to any land disturbance activities commencing on the site, the developer shall physically mark limits of no land disturbance on the site with tape, signs, or orange construction fence, so that workers can see the areas to be protected. The physical markers shall be inspected daily.

- Appropriate erosion and sediment control measures shall be installed prior to soil disturbance. Measures shall be taken to control erosion within the project area. Sediment in runoff water shall be trapped and retained within the project area. Wetland areas and surface waters shall be protected from sediment.

- Sediment shall be removed once the volume reaches ¼ to ½ the height of the silt fence or hay bale.

- Divert offsite runoff from highly erodible soils and steep slopes to stable areas.

- Land disturbance activities exceeding two acres in size should not be disturbed without a sequencing plan that requires stormwater controls to be installed and the soil stabilized, as disturbance beyond the two acres continues. A construction phasing plan shall be submitted to the Planning Department prior to any construction on the site. Mass clearings and grading of the entire site shall be avoided.

- Soil stockpiles must be stabilized or covered at the end of each workday. Stockpile side slopes shall not be greater than 2:1. All stockpiles shall be surrounded by sediment controls.

- The area of disturbance shall be kept to a minimum. Disturbed areas remaining idle for more than 14 days shall be stabilized.

- For active construction areas such as borrow or stockpile areas, roadway improvements and areas within 50 feet of a building under construction, a perimeter sediment control system shall be installed and maintained to contain soil.

- A tracking pad shall be constructed at all entrance/exist points of the site to reduce the amount of soil carried onto roadways and off the site.

- Dust shall be controlled at the site.

- On the cut side of roads, ditches shall be stabilized immediately with rock rip-rap or other non-erodible liners, or where appropriate, vegetative measures such as sod.

- Permanent seeding shall be undertaken in the spring from March through May, and in late summer and early fall from August to October 15. During the peak summer months and in the fall after October 15, when seeding is found to be impractical, an appropriate temporary mulch shall be applied. Permanent seeding may be undertaken during the summer if plans provide for adequate mulching and watering.

- All slopes steeper than 3:1 (h:v, 33.3%), as well as perimeter dikes, sediment basins or traps, and embankments must, upon completion, be immediately stabilized with sod, seed and anchored straw mulch, or other approved stabilization measures. Areas outside of the perimeter sediment control system must not be disturbed.

- Monitoring and maintenance of erosion and sediment control measures throughout the course of construction shall be required. The applicant shall submit an Operation and Maintenance Plan for temporary and permanent erosion control measures as part of the application package.

- Temporary sediment trapping devices must not be removed until permanent stabilization is established in all contributory drainage areas. Similarly, stabilization must be established prior to converting sediment traps/basins into permanent (post-construction) stormwater management facilities. All facilities used as temporary measures shall be cleaned prior to being put into final operation.

- All temporary erosion and sediment control measures shall be removed after final site stabilization. Disturbed soil areas resulting from the removal of temporary measures shall be permanently stabilized within 30 days of removal.

7. Naturalized Detention Basins

Naturalized basins are attractively landscaped basins that fit better into a natural landscape. Naturalized planting themes incorporate native plants and use an informal pattern to mimic the natural environment. They have several advantages over traditional basins, including:

- The deeper root systems of the native plant materials encourage infiltration, recharging groundwater tables and increasing base flows.
- The plants trap pollutants, increasing the water quality of the discharge.
- The vegetation serves to cool water temperatures and slow storm water velocities.
- They are visually more attractive and can help beautify a neighborhood, increasing property values.
- They require less maintenance. Generally annual mowing and periodic trimming of trees and plants is sufficient.

Minimum Design Standards

Naturalized basins shall be used in lieu of conventional detention basins wherever feasible. The following design standards shall be followed to achieve the maximum benefit:

1. The basin shall be easily accessible for maintenance.

2. Construct basin with a sediment forebay at the inlet, sized to hold a minimum of one year's worth of sediment accumulation if no other pre-treatment is proposed.

3. Construct basin to have a natural low flow channel with turf reinforcement material to remove pollutants and prevent erosion.

4. Incorporate a naturally landscaped area at the ground surface. The ground surface around the basin shall be large enough to be in scale with the overall landscaped area. The purpose is to filter and soften views from residential areas.

5. Plant all areas of the naturalized basin, including basin floors, side slopes, berms, impoundment structures, or other earth structures, with suitable vegetation such as naturalized meadow plantings or lawn grass specifically suited for storm water basins. Suggested plants include:

    a. Grasses: Big Blue Stem, Switchgrass and wildflower mixes. In wet areas, plant Sweetflag, Yellow Iris and Soft Rush for color and texture.

b. Shrubs: Red Chokeberry (Aronia arbutifolia), Silky Dogwood (Cornus ammomum), Arrowwood (Viburnun Dentatum), Cranberrybush (Viburnum trilobum).
c. Trees: Red Maple (Acer rubrum), River Birch (Betula nigra), Sweetgum (Liquidambar styraciflua), various Willows.

6. Trees may not be planted below the pool area of the basin. If shrubs are used, they must be adapted to wet or moist soils conditions.

7. Mulch may be used in shrub beds located within the pool area with a non-floating type mulch.

8. Group trees or shrubs to avoid a spotty effect.

9. Provide access to the basin for maintenance. Blend access area in with the surrounding landscape to the extent feasible.

10. The forebay/sediment trap shall be at least 10 feet long and sized to hold at least the annual sediment loading.

11. Maintenance access shall be planted with grass and at least 10 feet wide with a maximum slope of 15% and a maximum cross slope of 3%.

12. Provide a means to prevent soil compaction on the floor of the basin during construction.

13. Size treatment storage area to hold the water quality volume.

14. The perimeter of all basins shall be curvilinear so that from most edges of the basin, the whole basin will not be in view. A more traditionally shaped (oval or rectangular) basin may be permitted when conditions such as topography, parcel size, or other site conditions warrant. Basins shall follow natural landforms to the greatest extent possible or be shaped to mimic a naturally formed depression.

15. Place inlets and outlets to maximize the flow path through the facility. At a minimum, the flow path shall be twice as long as wide. Baffles, pond shaping or islands can be added within the permanent pool to increase the flow path. If there are multiple inlets, the length-to-width ratio shall be based on the average flow path length for all inlets.

16. Minimum 1 foot of freeboard above the 25-year storm elevation.

17. The interior slopes of the basin within the pool area shall not exceed a slope of four horizontal to one vertical.

18. A minimum of six inches of topsoil with at least 6% organic content shall be provided for all planting ground cover beds or lawn areas.

19. Low flow outlets shall be designed to prevent clogging.

20. For basins that cannot infiltrate the water quality volume, use a soil filter conforming to the following:

    a. Impoundment Depth – Peak storage depth within the filter area for water quality volume may not exceed 18 inches.

    b. Pipe layout and spacing – Layout of the pipe underdrain system must be sufficient to effectively drain the entire filter area. There must be at least one line of underdrain pipe for every 8 feet of the filter area's width. The slope of the pipe must be 1% or greater.

    c. Pipe bedding – Minimum 12 inches over top of drainage pipe, 6" thick at sides, and 6 inches below drainage pipe of clean well-graded gravel.

    d. Filter bed – The soil must consist of loamy, coarse sand. The soil filter must extend across the bottom of the entire filter area. The soil must be at least 18" deep and underlain by a gravel bedding. A nonwoven filter fabric shall be installed between the soil and gravel with sufficient permeability rates to drain the water quality volume.

    e. Surface Cover – The top of the underdrain system must be covered with a 4 inch layer of sandy loam and then covered with plantings consisting of species tolerant of frequent inundation.

    f. Underdrain outlet – Each system must discharge to an area capable of withstanding concentrated flows and saturated conditions without eroding.

8. Hydrologic and Hydraulic Criteria for All Designs

- Impervious cover is measured from the site plan and includes any material or structure on or above the ground that prevents water from infiltrating through the underlying soil. Impervious surface is defined to include, without limitation: paved parking lots, sidewalks, roof tops, driveways, patios, and paved, gravel and compacted dirt surfaced roads.

- Determination of flooding and channel erosion impacts to receiving streams due to land development projects shall be measured at each point of discharge from the development project and such determination shall include any runoff from the balance of the watershed which also contributes to that point of discharge.

- The specified design storms shall be defined as a 24-hour storm using the rainfall distribution recommended by the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS).

- Proposed residential, commercial, or industrial subdivisions shall apply these stormwater management criteria to the land development as a whole. Individual lots in new subdivisions shall not be considered separate land development projects, but rather the entire subdivision shall be considered a single land development project. Hydrologic parameters shall reflect the ultimate land development and shall be used in all engineering calculations.