National Flood Insurance Program
Community Rating System

CRS Credit for Stormwater Management

2020

FEMA

Note on this edition: This document was revised to reflect significant changes made in the 2013 edition of the *CRS Coordinator's Manual* and further updates in the 2017 *Coordinator's Manual*:

- The addition in 2013 of credit for controlling the volume of runoff as a part of design storm—DS.
- A new credit in 2013 for requiring the use of low-impact development—LID before construction of any "hard" facilities
- A revision of the credit for the public maintenance of private facilities—PUB in 2013. The credit now is provided for having the legal authority to inspect and maintain all private facilities within the community as needed, and using that authority when needed. The credit for inspecting facilities on an annual basis has been moved to Activity 540, element storage basin maintenance—SBM.
- In 2013 the credit for developing the watershed master plan in conjunction with the floodplain management plan was eliminated and replaced with a new credit for having a dedicated funding source for the implementation of the watershed master plan.
- In 2017 credit for developing a watershed master plan is available to coastal communities without riverine watersheds if they develop a plan to deal with sea level rise projected to occur from the effective date of the plan to at least the year 2100, using the minimum projection listed in the 2017 *Coordinator's Manual*.
- With the 2017 *Coordinator's Manual* the credit criteria of having regulations based upon the plan was eliminated as a credit criterion for watershed master plan—WMP.
- The 2017 *Coordinator's Manual* clarified that credit for stormwater management regulations—SMR is for on-site detention or retention only.
- In 2019, credit for SMR is no longer required for WMP credit.

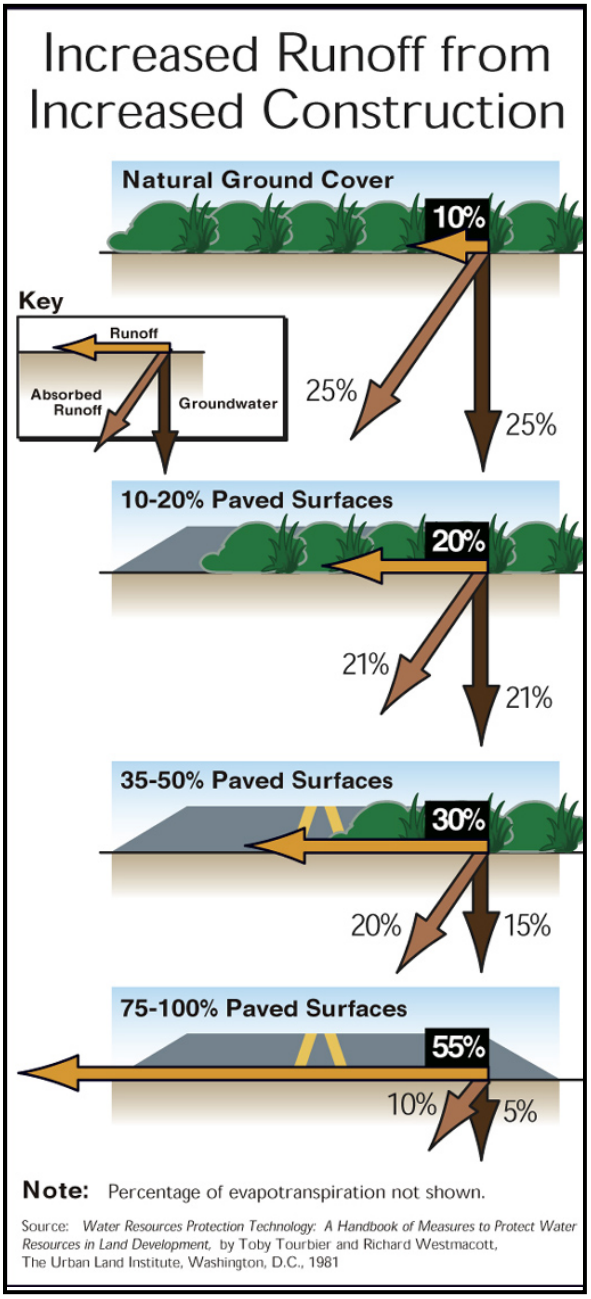
A community interested in more information on obtaining flood insurance premium credits through the Community Rating System (CRS) should review the *CRS Coordinator's Manual*. It and other publications on the CRS are available at no cost on the CRS Resources website

Contents

Introduction

Objective

One of the biggest problems of floodplain management in urbanizing areas is the increase in peak flow caused by development within a watershed. As forests, fields, and farms are covered by impermeable surfaces like streets, rooftops, and parking lots, more rain runs off at a faster rate. When an area is urbanized, the rate of runoff can increase five-fold or more.



This problem is compounded by changes in the surface drainage system. Stormwater runoff travels faster on streets and in storm drains than it does across forests or fields, or in natural channels. As a result, flooding is more frequent and more severe, channels begin to erode, and riparian habitat is lost.

Efforts to reduce the impact of increased runoff resulting from new development or increases in impervious surface in redeveloping a lot are known as "stormwater management." Stormwater management also encompasses many aspects of water quality, and includes efforts to reduce erosion and the entry of sediment and pollutants into receiving streams.

Among the objectives of the Community Rating System (CRS) are flood damage reduction and the protection of natural processes such as water quality and habitat for endangered species. These objectives are addressed by the elements in this CRS activity.

The CRS

The Community Rating System (CRS) is a part of the National Flood Insurance Program (NFIP). When communities implement regulations that exceed the minimum standards for floodplain management and/or administer programs to reduce flood damage and protect life and property, the CRS can provide discounts of up to 45% on flood insurance premiums for properties within those communities.

Communities apply for a CRS classification and are given credit points that reflect the impact of their activities on reducing flood losses, insurance rating, and promoting the awareness of flood insurance. The Insurance Services Office's ISO/CRS Specialist reviews the community's program and verifies the CRS credit. This includes a review of the written procedures and records of an activity, visiting sites in the field, and at times collecting examples of the

records. The total credit determines the community's CRS classification and the resulting insurance discount.

CRS credit criteria, scoring, and documentation requirements are explained in the *Coordinator's Manual*. The most recent edition can be downloaded from the CRS Resources website.

Regulations Recognized under Activity 450

The CRS credit for regulations governing the quantity and timing of runoff from new development, watershed master planning, and water quality management is provided under Activity 450 (Stormwater Management) in the *Coordinator's Manual*. This publication explains the CRS credit criteria and gives examples.

This activity recognizes four approaches to managing stormwater runoff from new development. They are detailed in Sections 452.a through 452.d of the *Coordinator's Manual*.

a. **Stormwater management regulations—SMR** require that, in new developments, the increase in peak flows that normally results from development be prevented or controlled onsite. The acronym used in the credit calculation formulae is "SMR." The credit criteria are explained in Section 452.a of the *Coordinator's Manual.*

b. Even when there is no increase in peak flows from a development site, the combined flows from a number of developments can still increase downstream peak flows. **Watershed master planning—WMP** can modify the regulatory standards to reduce or prevent these impacts and/or add structural measures to further reduce flood damage throughout the watershed. A master plan may also include elements to improve water quality and preserve the natural and beneficial functions of watersheds. The credit criteria for WMP are explained in Section 452.b of the *Coordinator's Manual.*

c. Sediment control is especially important in watersheds where land is being disturbed by construction. Instream habitat can be harmed and drainage systems cannot operate as designed if they are choked with sediment washed in from construction sites. **Erosion and sediment control regulations—ESC** are discussed in Section 452.c of the *Coordinator's Manual.*

d. Stormwater runoff picks up dirt, road oil, salt, fertilizers, and other substances. Regulations that require developers to install or implement measures that permanently improve the quality of stormwater are credited under the CRS. **Water quality regulations**—WQ are discussed in Section 452.d of the *Coordinator's Manual.*

This publication provides additional guidance on documenting and obtaining credit for the first two elements of this activity, SMR and WMP, and includes several examples from credited communities.

Activity 450 (Stormwater Management) can be made more effective through a comprehensive program of channel and basin maintenance and debris removal (elements CDR and SBM, respectively, under Activity 540 (Drainage System Maintenance) in the CRS). The two activities work together to minimize the increase in flood frequencies and heights that can result from development. The credit criteria and credit points for CDR and SBM are explained under Activity 540 in the *Coordinator's Manual*.

Regulations Recognized Elsewhere

The regulations credited under Activity 450 are related to controlling the impacts of increased development on runoff onsite (SMR) and to addressing the cumulative impact of development on flood risk throughout a watershed (WMP). Communities may have other regulations related to flooding or water resources protection. Many of these are credited under other CRS activities, such as those listed below.

- Requiring permit applicants to develop base flood elevations or study the impact of their projects on flood heights or velocities in Special Flood Hazard Areas (SFHAs) where such data have not been provided by the NFIP is credited under Activity 410 (Additional Flood Data).
- A community can receive credit for prohibiting new buildings in a specified area under either Activity 420 (Open Space Preservation) or Activity 430 (Higher Regulator Standards), but not under both. Activity 420 provides more credit points than does Activity 430 because new buildings are better protected from flooding if they are kept out of the SFHA in the first place. Therefore, most communities opt to credit prohibitory regulations under Activity 420.
- Activity 430 provides CRS credit for numerous regulatory standards that reduce flood damage, require new structures to be built above the 100-year flood level, provide for protection from local drainage problems, and generally improve floodplain management.
- Regulations on dumping or placing debris in stream channels are credited under Activity 540 (Drainage System Maintenance).

Legal Aspects

For the purposes of this activity, creditable regulations must be legally enforceable requirements placed on land use changes and development within the watershed. They do not have to be enforced by the community but they do have to be legally enforceable by a government agency. For example, requirements set by a county or regional drainage or flood control district may be credited if those entities have jurisdiction in the watershed and issue permits.

In most communities, regulations affecting stormwater management are commonly found in a subdivision code, land development code, stormwater management regulations, or stormwater or drainage manual that has been adopted by the community. Plans, such as land use plans and comprehensive plans, are usually recommendations, not regulations, and should not be submitted for credit. The requirements should cover construction projects throughout the community, but may be different in different parts of the community or watershed or for different types of development.

In some cases, an ordinance, especially a subdivision ordinance, will refer to state or local policies, specifications, a design manual, or other separate document. Many local officials have said, “developers don’t argue, they follow this manual because we tell them to.” Unless the separate policy document is specifically adopted by reference in the ordinance, the community will have to include a statement from its legal counsel that its policies and design standards have the force of law.

Similarly, some regulations state that something "may be required" or that a permit applicant "should" do something. The CRS CREDITS ONLY CLEAR AND EXPLICIT REGULATIONS that require specific actions or standards from a developer. In general, the word "shall" indicates such a requirement.

For example, the following language would NOT be credited.

> *If, in the opinion of the building official, the soils are not suitable for construction, appropriate fill and compaction may be required.*
>
> or
>
> *If the development will increase the depth of flooding on existing structures, the development must provide detention to prevent the increase.*

The following language WOULD be credited.

> *For all development, except a single-family residence, the applicant shall provide a stormwater management system that prevents any increase in flow for the 10-year and the 100-year design storms . . .*

Statements in the "purpose" or "objectives" section of an ordinance are not acceptable by themselves. The CRS credits the specific requirement, not a statement about a reason for adopting the ordinance. For example, many communities have language that says one of the objectives of the ordinance is "To prevent increased flooding of existing development." Nowhere else in the ordinance is there a reference to a specific design standard, or to the preservation of the existing hydrology of the system. Therefore, credit under Activity 450 (Stormwater Management) cannot be provided.

In some cases, state laws provide the authority for a state agency or a community to do something. Usually a state agency will implement regulations or a community will enact an ordinance pursuant to the state law. It is the subsequent regulations or local ordinance that must be submitted for CRS credit, not the authorizing or enabling legislation.

Sometimes a requirement is meaningless without the definition section of the regulations and/or the section exempting some development from meeting the standard. Instead of requiring developments to prevent an increase in flows from the 25-year event, some communities require flows to be held to the level anticipated in the "design storm." In these cases, the community also needs to submit the ordinance section that defines the "design storm." Many ordinances first require all development to obtain a stormwater permit, but then exempt new single-family residences, or all development resulting in under 10,000 square feet of new impervious surface. Again, the pertinent section on exemptions must be provided when requesting CRS credit.

As with all regulatory issues, the opinion of the community's attorney or corporate counsel is most important. If language is not accepted by the ISO/CRS Specialist or Technical Reviewer because it does not appear to be clear, explicit, or consistently enforceable, then the community may submit a letter on its attorney's letterhead stating that the debated item has the force of law.

Verification Visit

During the verification visit, the ISO/CRS Specialist will collect five recent drainage reports prepared by the engineers hired by local developers to verify enforcement of the community regulations. If fewer than 80% of the examples show compliance with the standards, then no credit is given for that element. The submitted drainage reports must show compliance with the local requirements or no credit can be verified. If a site is exempt from compliance it should not be included in the submission requesting credit for that element.

Example: A community has stormwater management regulations requiring that the post-development peak flow from the 100-year storm for all new developments that increase the impervious area by more than 5,000 square feet cannot be any greater than the pre-development peak flow from the same event. The community has no authority to inspect private stormwater facilities and does not require that low-impact development techniques be used before detention is provided. The community is applying for the following credit:

SZ = 90, because of the exemption for 5,000 square feet of new impervious surface; and

DS = 100, because the peak flow for a 100-year event cannot be increased.

SMR = 190, the sum of DS and SZ

The ISO/CRS Specialist asks to see and collect drainage reports for a convenience store, a neighborhood shopping center, and three residential subdivisions. Although the convenience store created more than 5,000 square feet of new impervious area, it was granted a variance to the detention requirement because the lot was crowded by the proposed development.

The community's credit for SMR is reduced to 80% of the credit anticipated by the regulation because the standard was not applied to all development. The verified score for SMR is

190 x 0.8 = 152

This credit is also adjusted by the impact adjustment as explained in Section 452 of the *Coordinator's Manual*.

452 Credit Points for Stormwater Management

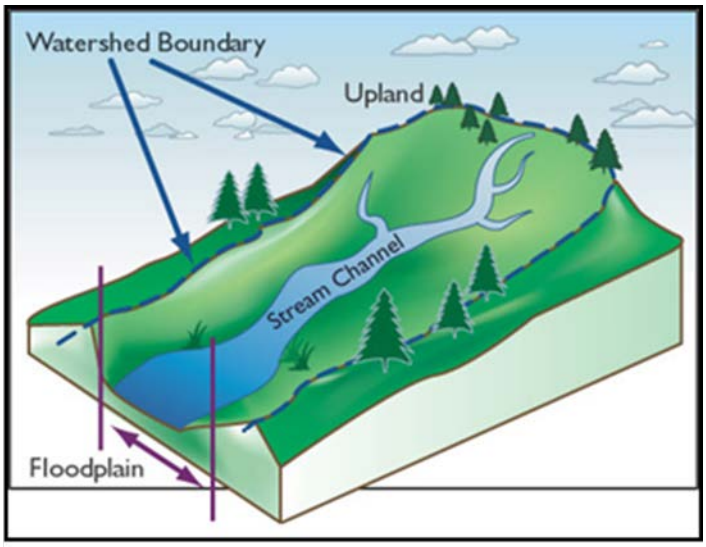
This section discusses two of the five elements (stormwater management regulations and watershed management master plans) and the corresponding CRS credit points under Activity 450.

This section also covers how the elements are scored, provides example ordinance language, and identifies some of the more common problems and misunderstandings found in community CRS applications.

452.a Stormwater Management Regulations—SMR

Why do we need stormwater management regulations?

The NFIP is based on the regulation of development in the SFHA to reduce future flood damage. However, roughly one-quarter of all NFIP policies and claims are for buildings outside the mapped SFHAs. Some of these buildings are adjacent to mapped SFHAs, but many are far removed from the flood hazards identified on a community's Flood Insurance Rate Map (FIRM).



Floods are generated from watersheds. Whether precipitation falls as water, ice, or snow, it will evaporate, infiltrate into the ground, or become surface runoff. The proportion that evaporates and infiltrates is dependent on a number of things. For rainfall, the primary factor is the intensity of the rain, vegetation, and the permeability of the ground surface. The harder it rains, the less water evaporates and infiltrates, and the more runs off over the surface. For snow, the primary factor is how fast it melts. This discussion will focus on rainfall but it is equally applicable to snowmelt.

A watershed, also called a drainage basin or catchment area, is the geographic area where the water for a river or lake originates (see figure). All lands in a watershed drain downhill toward a stream, lake, bay, or other body of water. The boundary of a watershed is called a divide. Stormwater runoff on one side of the divide drains to one body of water and runoff on the other side drains elsewhere.

As a watershed receives rainfall, water starts to flow on the surface. Water that falls next to a stream enters the stream immediately. Water from the higher elevations of the watershed does not reach the river until it has made its way down the slopes of the watershed. As the rain continues, more and more of the watershed is contributing flow to the stream, so the stream level rises and both its velocity and potential for erosion increase as well. If the rainfall intensity is steady, and the storm lasts long enough for water from the farthest point in the watershed to flow to the stream, the flow in the stream is usually very high.

When the rainfall ends, the river will gradually recede as the areas closest to the river quit contributing flow. The river will get back to its "normal" level when the upper parts of the watershed quit flowing.

This process is the same for a quarter-acre city lot with a house and for the Mississippi River until it enters the Gulf of Mexico. In the case of the city lot, the time from the start of the storm to the maximum rate of runoff is just a few minutes. For the Mississippi River, the time is several months.

A flood peak usually occurs when the watershed above the point of flooding receives rainfall for a long enough period that the entire watershed is contributing to the flow. At that point, the size of the peak flow is directly related to the intensity of the rainfall.

However, the peak flow at a point on a river is very much dependent on the nature of the watershed. In a mountainous area, a one-square-mile watershed might be fully contributing after a few minutes, while a one-square-mile watershed on the Great Plains might take several hours. The time it takes for the farthest point in a watershed to reach the river is called the "time of concentration." If the duration of a storm is equal to or longer than the time of concentration, the watershed will produce its highest peak flows for the intensity of that storm.

Storms have different intensities, but the highest intensities typically cover the smallest area. If a storm is five miles across, there will be some smaller areas where the rain is heavier than in others. The same is true for a tropical storm or hurricane that is over 100 miles in diameter.

Another factor in the peak flow from a watershed is the condition of the surface of the watershed. Imagine a 10-square-mile watershed (that is, about 2½ miles wide and four miles long) covered by dense forest. Much of the rainfall is absorbed by the organic litter under the trees. There is a relatively small amount of runoff. Then the forest is cleared and the land is subdivided for residential development. About half the watershed area is covered by roofs and streets. These impervious surfaces allow almost no infiltration, so the amount of runoff increases dramatically. Not only does the amount of runoff increase, but also the water runs off of roofs, into the streets, and into drainage ditches that carry it straight to the river much faster. The time of concentration has been decreased significantly, while the peak flows and total volume of runoff have increased significantly.

When the watershed was forested, the time of concentration was perhaps four hours. When it is developed, the time of concentration may be one hour. Now the watershed produces five times the amount of runoff, but it arrives at the river four times as fast. The result is a much higher peak flow and larger amount of total runoff. In the forest, if a ten-square-mile cell of intense rainfall hit the watershed for an hour, only a portion of the watershed contributed to the peak flow during that hour. Developed, the entire watershed contributes to the peak.

Stormwater management regulations require that each developer in the watershed ensures that the increased runoff from his or her development does not increase the peak flow downstream.

Stormwater facilities do not have to be "wasted" space in a development or in the community. The City of Las Vegas has nearly 300 soccer fields, many of them in city-owned detention basins. In a recently opened complex, there are five soccer fields at different levels, so that they are not all flooded frequently. Only one field is below the 10-year flood elevation in the detention basin.

Scoring SMR

SMR credit is provided if developers are required to prevent or reduce the increase in runoff that results from their project. To receive SMR credit, the watershed must be subject to a regulation that requires the peak and/or volume of runoff from new developments to be no greater than the runoff from the site in its pre-development condition, for at least the 10-year storm event.

SMR credit is the sum of the credit for four sub-elements:

SMR = SZ + DS + PUB + LID

If SZ = 0, or DS = 0, then SMR = 0.

The basic requirement is that the peak flow after development must not be increased at the downstream edge of the development as a result of the development. Additional credit can be earned if the total volume of water leaving the site during and after a storm is also unchanged. Picturing the change from farmland to subdivision, how is this done? Usually, the developer builds a storage basin at the lower end of the development (or, in a large development, multiple basins) to store or infiltrate the extra water that runs off. The developer typically is allowed to release the water from this storage basin at the peak flow rate before development. In most cases, these storage basins will empty in a few hours and be ready for the next storm.

Example Regulatory Language for SMR

From Section 14-40 Stormwater Management for Dekalb County, Georgia:

> *Section 14-40(b)(1) - DeKalb County shall require all land development to comply with the criteria, technical specifications, and standards of the Georgia Stormwater Management Manual, as may be hereafter amended.*
>
> *(2) Applicability. A combination of storage and controlled release of stormwater runoff shall be required for all development and construction for the entire site which meets one (1) or more of the following criteria;*
>
> *(B) Includes the creation of five thousand (5,000 square feet or more of impervious cover, or that involves other land development activities of one (1) acre or more;*

Section 14-40(b) requires

> *(14) The live detention storage to be provided shall be calculated on the basis of the one hundred-year frequency rainfall as published in the Georgia Stormwater Management Manual. The detention system required shall be necessary to handle the runoff of a one hundred-year rainfall, for any and all durations from the post-development, with a release rate that does not exceed the pre-development release rate during the same duration storm.*

452.a(1) Size of Development (SZ)

SZ credit can range from 15 points (increase in flows must be prevented only on projects 5 acres or larger, or for increases in impervious surface of 20,000 square feet or more) to 110 points (all projects are required to prevent an increase in flows). There is no credit if the regulations only affect developments larger than 5 acres or with more than 20,000 square feet of impervious surface or for self certification. The CRS does not credit regulations that apply only to these large developments because the cumulative effect of a number of small, unregulated developments could have a significant impact on runoff in small watersheds.

This sub-element recognizes that many communities do not want to impose the complexity of stormwater management on the owner of a small parcel. Therefore, a range of credit is available.

The maximum credit for SZ is 110 points. SZ is based upon the minimum size of the areas regulated, i.e., one of the following:

(a) 110, if all development is regulated, regardless of size;

(b) 90, if all development is regulated except single-family residences, land disturbance less than one-half acre, or increases in impervious area of less than 5,000 square feet;

(c) 60, if all development is regulated except for land disturbance of less than 1 acre or increases in impervious area of less than 10,000 square feet;

(d) 15, if all development is regulated except for land disturbances less than 5 acres or increases in impervious area of less than 20,000 square feet; or

(e) 0, if the regulations only apply to development of parcels larger than 5 acres or increases in impervious area of more than 20,000 square feet. If the regulations only cover such large development projects, there is no credit for SZ or SMR.

During verification of SZ, the impact adjustment is used, if needed, to reflect different thresholds for different types of development. For example, if a community regulates commercial developments larger than 2 acres and residential developments larger than 5 acres, an impact adjustment can be applied according to the percentage of current land use in each category.

Example Regulatory Language for SZ

Maricopa County, Arizona, regulates "all commercial, industrial, and multi-family residential developments and all subdivisions greater than one acre to provide retention of stormwater." This regulatory language receives 60 points for SZ because any development larger than one acre is required to retain the increased flow.

The Village Code of Downers Grove, Illinois, states that all development shall meet the stormwater requirements unless

> *. . . the with-development impervious area of the same development site . . . and the impervious area has[sic] not increased by a minimum of 25,000 square feet cumulatively of permitted development . . .*

This regulatory language does not qualify for SZ because it exempts up to 25,000 square feet of new impervious surface, which is more than the maximum allowed (20,000 square feet).

The Riverdale, New Jersey, code requires that all major development, defined as one-quarter acre or greater in size (Section 146(A)-2), show that the post-development rate of stormwater runoff does not exceed the pre-development rate. Because all developments larger than one-quarter acre are required to regulate stormwater runoff, the credit for SZ is 90.

Another community's stormwater management ordinance regulates "any development activity that will result in the accumulation of ten thousand (10,000) square feet of impervious area on any site." Such development is required to provide stormwater management to prevent any increase in flow for a creditable storm event. This language is worth 60 points for SZ.

Documentation Needed for Verification

The only acceptable documentation for SZ is the regulatory language describing the types and sizes of development that are required to keep post-development peak flows and/or volumes at or below the pre-development peak flows and/or volumes. The regulation may adopt a drainage manual, design manual, or stormwater manual. If so, a copy of the manual must be provided for review. The section of the regulation or manual that provides exemptions to the requirement must always be included and highlighted. Copies of five drainage reports for the various sizes of developments since the last cycle visit, prepared by the developer's engineer, must be submitted to demonstrate enforcement of the regulations.

Common Problems

- The most common problem communities have with this element is not having the appropriate community staff member available during the verification visit or collecting the examples. Often the CRS Coordinator is not familiar with the specifics of the stormwater management regulations and therefore needs the assistance of the appropriate staff.
- Communities fail to understand that regulation of, for example, all subdivisions, is not management of all development. To be eligible for full credit (110 points) for SZ, a community must regulate all development, including single-family residences in existing subdivisions that were developed before the standards were implemented.
- Communities do not understand the types and sizes of development that are exempt from complying with the standards.
- Communities rely on regional or state agencies for enforcement and have difficulty obtaining sample documents.

452.a(2) Design Storms—DS

DS credit is provided based on the return period (probability) of the storm used to design the required runoff control facilities NOT the design standards for culverts, storm drains, channels, or the first-floor elevation of new structures. For DS credit, the community's regulations must require calculations of both pre- and post-development hydrology and post-development runoff peaks must be limited to no more than pre-development levels at the site boundaries. The standard used may be peak flow or a combination of the peak and volume. There is a

bonus credit of 50% if regulations prohibit both increases in post-development peak flow and increases in post-development volume of runoff.

The maximum credit for DS is 225 points.

For DS credit, the community's regulations must require pre- and post-development hydrology calculations and post-development runoff must be limited to pre-development levels. The standard used may be peak flow, volume, or a combination of the two. DS is the total of the following points based on the design storms used in the regulations (i.e., the storms used to measure the impact of new developments):

(a) 100, if detention is designed to control the peak runoff from a 100-year storm, or 150 if the volume of runoff is also controlled;

(b) 36, if detention is designed for a storm larger than the 10-year but smaller than the 100-year storm, or 54 if the volume of runoff is also controlled; and

(c) 14, if detention is designed to control the peak runoff from a 10-year storm, or 21 if the volume of runoff is also controlled.

Although the 100-year flood is the basis for floodplain management, communities are also encouraged to look at the effects of stormwater management on smaller, more frequent storms. A design that maintains or reduces the peak flow from only the 100-year storm frequently allows for an increase in peak flows from smaller storms, resulting in increased flood damage.

Full credit (225 points) can be obtained in the following situations:

- If developers account for the runoff (peak flow and volume) from three storms: the 100-year storm, a storm larger than the 10-year but less than the 100-year, and the 10-year storm;
- If 100-year retention is required. For CRS purposes, retention (as opposed to detention) means that a basin has no outlet and stored runoff must be infiltrated into the soil, pumped out for irrigation, or otherwise disposed of on site; or
- If 100-year detention is required with a release rate shown to prevent increases in total volume released for any storm event above half of the two-year event.

The following examples help explain the formula for DS:

Design Storms Used	Points for DS Peak only	Points for DS Volume and peak
2-, 5-, and 10-year	14	21
2- and 25-year	36	54
10- and 25-year	50	75
2- and 100-year	100	150
25- and 100-year	136	204
10-, 25-, and 100-year	150	225

If the regulations are based on an allowable runoff of cfs/acre for a particular storm event, the value must be converted to a storm recurrence interval before it can be properly scored.

Stormwater regulations that focus on water quality do not receive SMR credit because they have little impact on flood flows. For example, some communities require retention of the first 1 inch of rainfall to reduce non-point sources of water pollution. In some areas this is less than a 1-year storm, so there is no credit provided under SMR, but the standard typically qualifies as a water quality measure (WQ) for credit under Section 452.d.

Example Regulatory Language

The Maricopa County, Arizona, regulation states that

> *The retention system shall be designed to receive and retain the volume generated from the 2-hour 100-year run-off event falling over the entire development including all rights-of-way, excluding off-site flows.*

Because the stormwater is RETAINED on the development, rather than being DETAINED, this language earns 225 points for DS. If the 100-year runoff is retained, all smaller storms are also retained. Water that is retained must generally be disposed of on the property, so there is no runoff.

The Stormwater Management Code for Newark, Delaware, requires that

> *Projects shall not exceed the post-development peak discharge for the 2, 10 and 100-year frequency storm events at the pre-development peak discharge rates for the 2, 10 and 100-year frequency storm events.*

This language is worth 114 points for DS because runoff from both the 10- and 100-year storms is regulated.

South Elgin, Illinois, requires that the 100-year storm runoff be significantly reduced. Section 9-29.B requires a "release rate of 0.1 cfs/acre or lower for the 100-year event. . . ."

By detaining the 100-year storm and releasing it at a rate lower than the 10-year pre-development rate (previous analysis has shown this rate of 0.1 cfs/acre locally is less than the rate before any land disturbance), this regulation earns 150 points for DS for peak flow control. No volume control is credited.

Documentation Needed for Verification

The only acceptable documentation for DS is the ordinance language that specifies the design storms used by the developer's engineer. In some cases, the regulation adopts a design manual that designates the required design standards. In this case, appropriate pages from both the regulation and the design manual are needed for verification. The drainage reports submitted as verification for SZ will be used to verify the score for DS.

Common Problems

- The most common problem communities have with documenting this element is determining which design storms are used. This problem almost always occurs when

someone other than the community staff person responsible for permitting new development tries to assemble the documentation.

- Another, less frequent problem arises when a parameter other than the recurrence interval for the design storm is used to determine either the required storage volume or the allowable discharge rate. For example, the regulation may say, "Detention must be provided for the first 1.0 inch of rainfall," or "the discharge cannot exceed 0.15 cubic foot per second per acre." In these cases, the community must provide documentation that relates the parameter in its regulation to the recurrence interval of a storm in its area.
- Some communities use different design storms for different aspects of development. A community's standards may say that underground storm drains must be designed for the 10-year storm, runoff from the 25-year storm must be contained within drainage easements, and buildings must be protected from runoff from the 100-year storm. CRS credit for DS is based entirely on the storm used to design detention or retention facilities, not on conveyance.

452.a(3) Low-impact Development (LID)

Low-impact development is a term that refers to site design techniques developers and homeowners can utilize to minimize the drainage impacts of new development (primarily new impervious surfaces). Low-impact development has been encouraged by the U.S. Environmental Protection Agency and many states as a mechanism to reduce the total volume of runoff from new development, recharge groundwater supplies, and provide significant water quality benefits. In order to receive CRS credit for element LID, the community must REQUIRE that low-impact development site-design techniques be used to reduce the amount of impervious surface and increase the amount of infiltration within a new development to minimize stormwater runoff for the DESIGN STORMS. Additional detention may be required to meet the community's flow control requirements, but the size of these facilities should be significantly smaller than if low-impact development techniques had not been used.

Low-impact development employs principles such as preserving and recreating natural landscape features, separating roof drains and minimizing effective impervious areas to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product.

Many practices have been used to adhere to these principles, such as narrow streets, cluster development, bio-retention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. By implementing low-impact development principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, low-impact development can help to maintain or restore a watershed's hydrologic and ecological functions.

Communities that require new development and redevelopment to implement low-impact development for all development, even new single-family homes, can receive up to 25 points. The actual credit is based on the credit for SZ.

Credit for LID is only provided if the community's stormwater management ordinance REQUIRES the use of "soft" techniques to reduce runoff to the maximum extent possible before using detention to meet the peak flow requirements. Encouraging, or allowing, the use of low-

impact development is not sufficient. The community must require its' use to the maximum extent possible to reduce flows in order to receive credit. This can be thought of as a requirement to mimic natural hydrologic runoff and minimize the impact of land development on water resources to the maximum extent possible. The developers are required to control the runoff, but detention ponds are discouraged in favor of on-site infiltration.

The following language is from a CRS community and would receive LID credit.

> *Small scale stormwater management practices, non-structural techniques, and better site planning to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources must be implemented. Only when it is absolutely necessary is the use of a structural BMP warranted.*

452.a(4) Public Maintenance (PUB)

Frequently, stormwater management regulations leave it up to the developer, the owner, or a homeowners' association to assume responsibility for maintenance of the required detention and infiltration facilities. Because experience has shown that private maintenance of stormwater management facilities is not as reliable as public maintenance, CRS credit is provided to encourage communities to have the authority to inspect private facilities and to require the owners to perform appropriate maintenance when necessary, or to require that those facilities be dedicated to the community

The maximum credit for PUB is 20 points, for having legal authority to perform inspections and maintenance of all private stormwater storage facilities. PUB credit must be obtained before SBM credit under Activity 540 can be earned.

A community can receive PUB credit only when the owners of all new facilities are required to allow the community to inspect their facilities as necessary and perform the required maintenance or force the owner to perform that necessary maintenance.

This ability must be supported by clear regulatory authority. Credit is not provided for a policy or a statement with which the community has been able to get compliance in the past.

Example Regulatory Language

The drainage regulations for Omaha, Nebraska, requires the maintenance of post-construction best management practices (BMPs), including detention facilities. The ordinance specifies that

> *Such agreement shall provide for the access to the facility, at reasonable times, for inspections by the city or its authorized representative to ensure that the facility is maintained in proper working condition to meet design standards.*

Documentation Needed for Verification

The only acceptable documentation for PUB is the regulatory language that applies to all storage basins required by the regulations credited for SMR. No examples of easements or inspection are necessary for this element.

The regulatory language must clearly state that the community has the right to enter the property, and has the authority to perform required maintenance if the owner fails to do so.

Common Problems

The most common problem with PUB credit is that communities do not maintain their authority to inspect permitted facilities after construction.

452.b Watershed Master Plan—WMP

Why do we need watershed management plans?

Even if every developer controls the runoff from his or her development so that peak flows are not increased, downstream peaks and durations of flooding still may increase. If only peak flow is regulated, then when the volume of runoff increases, the duration of high flows from the development also increases. As these high flows move down the watershed and combine with the releases from other development, the combined peaks frequently are higher and last longer than those before development. This is why communities are required to model future land use using a hydrograph approach to account for both the increased volume of and the increased duration of runoff.

This impact can be mitigated or avoided by using watershed management master planning. A watershed master plan estimates the runoff from different parts of the watershed based on FULLY DEVELOPED conditions. The results of the plan could show, for example, the desirability of modifying the existing onsite detention regulations, increasing future maintenance, using future-conditions flood maps and regulations based upon them, or creating a capital improvement program to account for the anticipated problems.

A watershed master plan is the result of a hydrologic and hydraulic study of the watershed using a hydrograph approach, examining both existing and future development conditions, and under different management scenarios. For CRS credit it must model at least the 100-year fully developed watershed at a scale sufficient to determine local problems. This typically may include the modeling of the constructed drainage system in order to identify local problems. For credit it must include recommendations that address the flooding problems found for at least the 25-year event.

Credit for WMP is provided only if the community has implemented the recommendations in the plan to ensure that peak flows for the 10-year and the 25-year events are not increased by future development. In general, the plan must

- Have been adopted by the community, and
- Manage all storms up to and including the 25-year storm through actions recommended by the plan. (No credit is provided for WMP if only storms smaller than the 25-year storm are managed.)

A watershed master plan can work with other planning tools used by the community to help accomplish other community objectives. Knowing the present and future conditions of runoff from streams too small to be included by FEMA on the community's FIRM allows the creation of local regulatory maps that can be used to ensure that development is safe from flooding. The information can also be used to protect streams, preserve open space corridors, protect wetlands and other habitat, and support other actions that generally improve the quality of life throughout the community. Additional CRS credit is provided for some of these planning aspects.

A significant failing of many planning efforts is the lack of a funding source to implement the recommendations contained in the plan. Many communities have adopted stormwater utilities, real estate taxes, or have created some other dedicated revenue stream to address this issue. Communities that have a dedicated funding source specifically to implement their plan can receive additional credit.

Example Outline for
A Watershed Master Plan

I. Executive Summary
II. Introduction
III. Existing Conditions
  A. Land Use – impervious coverage, streams, wetlands, open space
  B. Model (25 and 100-year events at a minimum using a hydrograph approach)
  C. Identification of issues
IV. Future Conditions
  A. Fully developed land use and sea level rise
  B. Model (25 and 100-year events at a minimum using a hydrograph approach)
  C. Identification of Issues
V. Alternative Analysis
  A. How do land use/stormwater regulations affect future conditions?
  B. How can detention/conveyance address current and future issues?
  C. Should redevelopment be regulated?
VI. Recommendations
  A. Capital Improvement Program
  B. Land Use (zoning) modifications
  C. Regulatory changes
  D. Creation of a dedicated funding source
  E. Buffers
  F. Maintenance changes

Credit Criteria for WMP

Watershed master plans must meet four prerequisites to be eligible for CRS credit. If these four criteria are met, the community receives a basic credit of 90 points. The community then can receive additional points for other standards in the plan.

(1) The community must have adopted a watershed master plan for one or more of the watersheds that drain into the community that

  a. Evaluates the impact of future conditions for at least one watershed that drains into the community for multiple storm events, including the 100-year storm. The plan must identify the natural drainage system and constructed channels; OR

  b. Evaluates the future conditions, including the impacts of sea level rise, based on NOAAs "intermediate-high" projection for the year 2100 on the local drainage system during multiple rainfall events, including the 100-year rainfall event. This option is for coastal communities with no natural or constructed channels. Guidance on sea level rise projections for CRS purposes can be found in Section 404 of the *CRS Coordinators Manual*.

To receive WMP credit the community's governing board must have adopted the plan(s). Even if the plan does not have the authority of a regulation, adoption indicates that the community accepts the standards and other provisions included in the plan and intends to implement them.

Regardless of how the community got started on master planning, the plan must include studies of current- and future-conditions land use to determine the change in runoff from current to future, fully developed conditions. Current conditions are generally studied to show the existing problems. Future, fully developed conditions are commonly studied to

locate problems that may be caused by new development and to justify regulation of new development and expenditures on structural elements of the plan. For a fully developed watershed, a community need only look at the existing development and the potential impact of any redevelopment.

"Manage future peak flows" means management of runoff from the entire watershed so that increased flows are controlled throughout the watershed. Stormwater management regulations generally control peak flows from individual developments, but they do not control the timing of flows through the watershed. A watershed master plan examines the cumulative effects of watershed development and provides information needed to control the timing of peak flows to prevent or minimize problems.

(2) The community must have adopted or implemented the plans recommendations on managing all storms up to and including the 25-year event. Coastal plans must include recommendations on how to manage the drainage system to maintain and/or improve the existing level of service with rising sea levels. "All storms" includes at a minimum the 10-year storm in addition to the 25-year event. Management of a 2-year storm is also recommended.

Many documents called watershed master plans have been developed to guide the construction or reconstruction of storm drain systems. These documents are usually comprehensive reviews of a watershed's or basin's hydrology. They can be eligible for WMP credit if the community has adopted regulator standards preventing new developments from increasing peak flows from both the 10-year and the 25-year events, or a larger event or has created a capital improvements plan to handle the increase in flows and prevent increased downstream flooding.

(3) For any plan that is more than five years old, the community must evaluate the plan to ensure that it remains applicable to current conditions. The evaluation must address whether the data used for the plan are still appropriate and whether the plan effectively manages stormwater runoff. The community must update a watershed master plan that becomes obsolete, or the WMP credit will be revised accordingly.

The purpose of CRS credit for watershed master planning and stormwater management regulation is to protect the existing natural and beneficial functions of streams and to reduce flood damage that results from development in watersheds. Regulation and planning for smaller storms is effective in improving water quality but does little to reduce flood damage.

Like other plans, watershed master plans become obsolete. This can happen for several reasons:

- Rainfall data added to an old record can change the magnitude of the design storm(s) that is used to generate runoff data;
- The projected levels of sea level rise can be updated;
- Downstream flows can be altered as a result of changes such as channel improvements and new detention basins;

- Over time, actual land use may differ from the projected land use on which the watershed master plan was based; and
- Over time, new methods are developed for the hydrology and hydraulics used in stormwater projections.

There may be other considerations when deciding if a watershed plan is obsolete.

If a watershed master plan is more than five years old, the community must certify that the plan is still applicable and not obsolete. The certification must address the issues included in the documentation requirement, Section 452.b.1(a)(v), beginning on page 450-18 of the *Coordinator's Manual*.

Scoring WMP

For WMP, credit must be received for item (1) in order to receive any credit for the other items. WMP is the total of the following:

(1) 90, if the watershed management plan meets all of the credit criteria listed in Section 452.b.

After a watershed master plan meets the four credit criteria, additional WMP credit is awarded for (2) through (8), below):

(2) 30, if the plan manages the runoff from all storms up to and including the 100-year event.

Additional credit is provided if the community's regulations manage all storms up to and including the 100-year storm or the community has another acceptable method of managing all storms. "All storms" includes specifically listed storms, such as the 2-, 10-, 25-, 50-, and 100-year storms. For coastal plans that address sea level rise this must include a description of actions the community could take to address the expected impacts of sea level rise on its drainage system and on flooding within the community.

(3) 55, if the plan provides for management of future peak flows AND VOLUMES so that they do not increase over present values.

The more common approaches are when a community disposes of its increased volume of stormwater to an aquifer through groundwater recharge, or uses the water for irrigation or other purposes. For this credit, the community must retain the increased runoff due to development, although it may be allowed to detain and discharge an amount of water equal to the pre-development runoff. As with any retention system, sufficient storage must be created to handle a later storm that occurs before the retained water is disposed of.

(4) 35, if the plan manages the runoff from all storms up to and including the 5-day event.

There are usually at least three "worst-case" runoff events for a particular recurrence interval storm: one that causes the highest peak discharge from the development; one that causes the highest peak discharge from the watershed (this is usually also the greatest total volume of flow); and one for the stream into which the watershed discharges. Most

communities plan for the first two, which may range in duration from a few minutes to a few days. Fewer plan for the third, which may last from a few days to several weeks.

This credit is provided for assuring that the most appropriate modeling techniques are used for the location. This is assumed to be a 5-day event unless the community can show that a shorter event is more appropriate for local conditions. In some areas this may require continuous-simulation modeling. If a community, regional, state, or federal agency can demonstrate that, for example, the 72-hour event provides the "worst case" runoff for a watershed, then the 72-hour event would be credited for communities in that area. Generally, the "worst case" runoff will occur when the time of concentration for the watershed is about equal to the duration of the storm event used for modeling.

In many locations, a state or federal agency or a regional stormwater management or flood control agency has determined the storm duration that causes "worst-case" flooding, including flooding on larger rivers. If that agency states that a certain storm duration is appropriate for the large rivers within its jurisdiction, the community may receive credit for using that storm duration. Using continuous simulation modeling is also credited.

(5) 30, if the plan identifies existing wetlands or other natural open space areas to be preserved from development so that natural attenuation, retention, or detention of runoff is provided.

Preservation of these areas reduces runoff and flood damage and provides other floodplain management benefits as well. A community must have mapped and implemented regulations or a program that preserves the identified areas in order to receive this credit.

(6) 25, if the plan prohibits development, alteration, or modification of existing natural channels and the community has adopted a qualifying ordinance.

Where the watershed master plan includes undeveloped areas, preservation of the natural channels may reduce maintenance costs, protect riparian habitat, preserve ecosystem services, and provide many amenities to the community.

(7) 25, if the plan requires that channel improvement projects use natural or "soft" approaches rather than gabions, rip rap, concrete, or other "hard" techniques and the community has adopted appropriate design standards or ordinances.

Even where communities are preserving existing natural drainageways, they may not have the needed capacity for a large storm. In these cases, the community may choose to use vegetation for erosion control or along the improved channel instead of rip rap or concrete.

(8) 25, if the community has a funding source dedicated to implementing the plan's recommendations.

In many cases, a community's watershed management plan recommends changes to regulatory requirements or design standards and, most often, projects to reduce flooding problems or handle future runoff. Without a dedicated funding source, many communities

are unable to complete the projects in a timely manner. Therefore, additional credit is given to communities willing to raise the money locally to implement their plans.

This credit is dependent upon the community's having a tax or utility fee dedicated solely to the implementation of its watershed master plan.

Example Program

Thurston County, Washington, adopted the Green Cove Creek Comprehensive Drainage Basin Plan. The goals of comprehensive drainage planning in Thurston County are to

- Preserve and/or enhance water quality, stream morphology, wetlands, groundwater, fisheries/wildlife habitat, and aesthetic amenities;
- Promote sustainable development within each basin (i.e. minimum impact on water resources and habitat);
- Promote public interest and involvement in water resource management;
- Establish short-term and long-term solutions to existing and future stormwater quality and quantity problems; and
- Promote a regional approach for financing, ownership and operations/ maintenance of regional facilities and programs.

Although "solutions to . . . stormwater . . . quantity problems" is only part of one of these goals, the Green Cove Creek plan names flooding as the first problem, and solutions to flood problems as the highest priority. The plan recommends measures to deal with increased runoff due to urbanization, undersized culverts, sedimentation, inadequate design of existing facilities, and areas with high water tables.

Documentation Needed for Verification

To obtain credit for WMP, the community must submit documentation that the plan was adopted and a copy of those pages from the plan that support the credit requested. There must be language in a "hydrology" or "study methods" section of the plan to define the design storm(s) used to develop the plan, as well as a comparison of current- and future-conditions runoff.

Common Problems

Many watershed plans are produced with the aim of managing water quality within a watershed and do not address flooding or quantity controls. These are typically done to fulfill National Pollutant Discharge Elimination System permit requirements and rarely receive CRS credit. Many other plans have looked only at existing conditions or conditions expected within a few years, rather than at the fully built-out watershed.

Impact Adjustment

The CRS measures the impact of an activity on the community. It does not matter if the stormwater management program is administered by the community, upstream communities, or by a regional district. What counts is that the buildings, property, and streams in the community are protected from increased runoff that results from development in the watershed.

Most communities occupy or are affected by several watersheds. These may include a large watershed that drains to a large stream and a number of small watersheds that drain into creeks or ditches that enter the community from other locations.

A community that can regulate all development in all watersheds that drain into it should receive full credit for this activity. This is not the case for most communities since corporate boundaries rarely coincide with watersheds. Most communities do not have jurisdiction over new development outside their corporate limits or outside an extraterritorial limit. Because these communities cannot regulate all of the watersheds that drain into them, their CRS credit points are adjusted to reflect the limits of their stormwater management programs.

To provide the appropriate credit, Activity 450 uses impact adjustments for SMR and WMP that factor in the area of the watersheds affected. Impact adjustments for Activity 450 differ from the adjustments applied under other CRS activities because the effectiveness of stormwater management depends on how much of the watershed is affected by a creditable stormwater program, while the impact of other activities is based on how much of the SFHA is affected, or how many buildings are affected. Although the boundaries of SFHAs are readily available on FIRMs, most communities will have to delineate their own watersheds.

The impact adjustments for SMR and WMP are ratios that are multiplied by the elements' credit points. The ratio for SMR is rSMR and the ratio for WMP is rWMP.

Communities are encouraged to manage stormwater in cooperation with adjacent communities. If a community has regulatory jurisdiction over only a portion of its watersheds, then it does not receive the full benefits of stormwater management. However, if upstream communities also manage future development, either independently or through a state or regional agency, all communities can benefit. Therefore, if a community can demonstrate that all upstream communities in its watershed have similar stormwater management programs, it will receive more credit.

The impact adjustment adjusts the credit for SMR and WMP in accordance with the portion of the watershed regulated.

1. **Stormwater management regulations—SMR.** A community must develop a stormwater Impact Adjustment Map (explained below) to determine the impact of its stormwater regulations (rSMR):

$$rSMR = \frac{aSMR}{aW}, \text{ where}$$

aSMR = the area subject to stormwater management regulations, and
aW = the area of all watersheds affecting the community.

It is necessary to show the entire drainage area that affects the community (aW) and the community boundary on the Impact Adjustment Map. The area regulated by the community (aSMR) is usually the same as the area of the community. The area regulated (aSMR) and the area of the watershed (aW) both must be provided by the community.

2. **Watershed management master plan—WMP.** A community must develop an Impact Adjustment Map (explained below) to determine the impact of its watershed master plan (rWMP):

$$rWMP = \frac{aWMP}{aW}, \text{ where}$$

aWMP = the area included in the watershed plan, and
aW = the area of all watersheds affecting the community. The area of each watershed master plan (aWMP) must be provided by the community.

A community may prepare an Impact Adjustment Map later with the assistance of the ISO/CRS Specialist.

Common Problems

Communities often fail to understand that the impact adjustment for this activity usually includes drainage areas outside of the community. The impact adjustment gives the community credit for stormwater management based on the portion of the watershed affecting the community that is managed. The area with stormwater management regulation, aSMR, is divided by the total watershed that produces runoff through the community, aW, which usually extends beyond the area of the community's jurisdiction.

Communities can receive credit for upstream communities' control of their runoff, but only if they provide all the documentation to verify the upstream community's management.

The same calculation is done for areas with watershed master plans, and aW is the same for both calculations.

If a community does not calculate an impact adjustment and provide an Impact Adjustment Map, then an impact adjustment value of no more than 0.15 for both rSMR and rWMP may be used.

Example: Big County covers 1,000 square miles. Drainage into the county, excluding watercourses with watersheds larger than 50 mi^2, is 100 mi^2.
NOTE: drainages larger than 50 mi^2 at the point at which they enter the community can be excluded from the calculations.

aW for Big County = 1,100 mi^2.

Big County has one large city, Central City, and two small communities that are in other parts of the county. Central City and adjacent areas have 80% of the county's

population. Big County and Central City have jointly completed watershed master plans for all watersheds that drain through Central City. These watersheds total 330 mi^2.

Based on area, rWMP = $\frac{330\ mi^2}{1{,}100\ mi^2}$ = 0.30

The Impact Adjustment Map

A community that wants to earn more than the basic 0.15 impact adjustment must develop an Impact Adjustment Map to show where the stormwater regulations apply in each watershed, where each watershed management plan has been implemented, and the areas of each.

The stormwater Impact Adjustment Map shows the community and all watersheds that drain into it. Watersheds larger than 50 square miles (as measured where the stream enters the area under the community's jurisdiction) do not need to be shown. Although the purpose of this map is similar to the Impact Adjustment Map discussed in Section 403 of the *Coordinator's Manual*, it may be quite different in appearance. The community will likely be only a small part of the total watershed.

Areas may be measured in acres or square miles. The area subject to the stormwater management regulations is shown as aSMR and the total area of the watershed is aW. aSMR is typically the area of the community plus any area subject to its extraterritorial jurisdiction. The area covered by the watershed management plan is aWMP. If the community wants credit for the management of stormwater by upstream communities, those communities must be shown on the map, their areas of jurisdiction calculated, and their standards submitted for review.

It is typical for an Impact Adjustment Map to be developed using a geographic information system (GIS) and for the areas to be calculated using GIS. Although this activity is reviewed by a technical reviewer for all CRS communities, in many cases the ISO/CRS Specialist examines the Impact Adjustment Map during the community visit and may comment on its adequacy.

The CRS encourages communities to provide high-quality mapping and data to accurately reflect their programs and maximize their credit. Here are some ways to make it easier.

- Watershed area data are often found in the community's Flood Insurance Study and other stormwater reports, such as "205" studies.
- If a community can demonstrate that upstream communities have similar stormwater management regulations for the upper portions of their watersheds, it can increase the size of aSMR and aWMP. A community in a regional district that regulates all watersheds should get credit for all areas affected.

- The following areas may be excluded from the calculations for aSMR, aWMP, and aW:
  - Watersheds larger than 50 square miles (as measured where the stream enters the area under the community's jurisdiction) may be excluded. The area of the watershed within the community remains in the impact adjustment calculation.
  - If such large watersheds are outside the community's jurisdiction, or are not regulated, the community will receive more credit by excluding them. If they are regulated, the community will receive more credit by including them.
  - If watersheds upstream of the community are effectively reduced by flood control structures that control the base flood, the size of the areas affected is reduced accordingly. Only dams designed to control the base flood can be used for this type of adjustment to aW.
  - If parts of the watersheds are unlikely to be developed due to their ownership, those portions of the watershed may be excluded. Examples of these areas are nature preserves, state parks, or privately owned land that is dedicated to open space use.

Example: Hilton Head Island, South Carolina

Excerpts from the Hilton Head Island stormwater management program are given on the following pages to serve as a scoring example. This example program is not meant to be copied and adopted. THIS IS STRICTLY AN EXAMPLE. A stormwater management program must be tailored to local conditions and developed with adequate technical input.

NOTE: *Communities are advised to have all proposed ordinance language reviewed by their attorneys or corporation counsels.*

Hilton Head Island has a fairly simple stormwater management program. Its regulation requires that all new development, except single-family residences on existing lots, ensure that the flows of the 25-year storm do not exceed the flows from the site under pre-development conditions. Because the community is an island, all watersheds are regulated and the community uses a value of 1.0 for its impact adjustment.

Credit Points

Stormwater Management Regulations—SMR

1. Size of development—SZ. Hilton Head Island's ordinance is applicable to virtually all development except single-family residences, agricultural activities, and temporary work done during emergencies.

> *Sec. 16-5-109.B. Applicability; Exceptions*
>
> *1. Except as otherwise provided in paragraph 2 below, this section applies to all development.*
>
> *2. Exceptions*
>
> *The following development is exempt from the standards in this section.*
>
> *Development exempt from Development Plan Review in accordance with Sec 16-2-103.G.3. Exemptions*
>
> *The establishment of, or additions or modifications to, a single family dwelling or its accessory structures……*
>
> *Development that does not disturb more a total of ½ acre of land or alter or disrupt existing drainage patterns.*

Based on this requirement, SZ = 90.

2. Design storm—DS. Hilton Head Island's ordinance requires that the 25-year storm be accounted for in all development.

> Sec. *16-5-109.D. Drainage Design Standards*
>
> *1.c The design storm to be used in the design of all drainage systems and permanent stormwater management facilities, is the 25-year frequency/24-hour/8.4 inch rainfall and Antecedent Moisture Condition II (AMC II).*
>
> *2.a All development shall incorporate stormwater management facilities sufficient to ensure that for the design storm and Type III rainfall distribution, the post-development peak discharge rate across adjacent property lines will not exceed the pre-development discharge rates.*

DS = 36

3. Low-impact development—LID. Hilton Head Island does not require implementation of low-impact development techniques, but does recommend their use.

LID = 0

4. Public maintenance—PUB. Hilton Head Island requires owners to maintain stormwater facilities. The city has the right to enter these facilities for inspections and to perform maintenance if necessary.

> *Sec. 16-5-109.H.2.b. Drainage Easements*
>
> *b. Authorize the Town, State, or other legal entity having authority to enforce stormwater management requirements to perform, or require the homeowners or property owners association or landowner to perform actions necessary to:*
>
> *i. Correct any lack of maintenance resulting in an adverse effect on drainage flow, or*
>
> *ii. Alleviate flooding or other emergency drainage problems upstream or downstream of the development site.*

PUB = 20

SMR Credit

The credit for SMR is the sum of the three sub-elements: SMR = SZ + DS + PUB.

SMR = 90 + 36 + 0 + 20 = 146

Watershed Management Master Plan—WMP

Hilton Head Island has no watershed master plan, so WMP = 0.

Impact Adjustment

Because it is an island, the area of Hilton Head Island equals the total area of its watershed. All of its watershed is subject to its stormwater regulations, so rSMR = 1.0.

Credit Calculation

cSMR = SMR x rSMR

cSMR = 146 x 1.0 = 146

454 Credit Documentation

Hilton Head Island must submit the following required documentation:

- A copy of the standards regulating surface water runoff from new developments in the watershed. For SMR credit, the language must require that peak runoff from new development be no greater than the runoff from the site in its pre-development condition. The margin next to where this appears in the ordinance must be marked "SMR."

  The language submitted must include those factors that are credited: size of development regulated, design storms to be used, whether low-impact development is required, and how the maintenance of drainage and retention facilities is handled. The appropriate acronym(s) (SZ, DS, LID, and PUB) must be marked in the margins of the sections of the ordinance that pertain to each element.

Hilton Head Island provides a copy of Article IV Stormwater Management Standards, Sections 16-5-601 through Section 16-5-608 of its city code, with the acronyms SZ, DS, and PUB marked in the margins. Each page of the code has the latest revision date in the footer, so there is no need for further documentation of the adoption date of the code.

- An Impact Adjustment Map showing watershed boundaries and stormwater management jurisdiction.

During the verification visit, the ISO/CRS Specialist verifies that Hilton Head Island is entirely located on a barrier island. He or she makes a note of this and sends it to the technical reviewer with Hilton Head Island's other documentation.

- The community must have the following documentation available to verify implementation of this activity, the community must have available drainage reports prepared by the applicant's engineer showing that the development meets the requirement that peak flows not increase. A comparison of the flows for the design events before development compared to those after development is required.

During the verification visit, the ISO/CRS Specialist asks for copies of the drainage reports submitted for several recent developments required to provide stormwater detention under the city code.