Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

STORMWATER RUNOFF CONTROL

CODE 570

(ac)

DEFINITION

Measures or systems to control the quantity and quality of stormwater runoff.

PURPOSE

This practice is used to accomplish one or more of the following purposes in controlling stormwater runoff:

- Minimize erosion and sedimentation during and following construction activities
- Reduce the quantity of stormwater leaving developing or developed sites
- Improve the quality of stormwater leaving developing or developed sites

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where stormwater runoff causes or may cause undesirable downstream conditions such as flooding due to increased flows, sedimentation, channel degradation, and/or degradation of surface or ground water quality if left untreated. This practice may apply both to sites undergoing development as well as remedial work on developed sites. This practice does not include runoff from areas of livestock facilities. For runoff from livestock facilities use practices such as NRCS Conservation Practice Standards (CPSs) Waste Storage Facility (Code 313) and Vegetated Treatment Area (Code 635).

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct stormwater runoff controls to comply with applicable Federal, State, and local laws and regulations, including all necessary permits and utility locations.

The peak discharge from the 2-year and 100-year, 24-hour storms shall be analyzed. No increase in peak discharge from these storms shall be allowed unless downstream increases are compatible with the overall flood plain management system.

Develop a plan to reduce the impacts of stormwater runoff from the site based on an assessment of the downstream area. As applicable, include in the plan practices or management activities that will—

- Reduce onsite erosion.
- Reduce offsite impacts from sedimentation.
- Reduce the quantity of stormwater leaving the site to levels that will not adversely affect downstream receiving channels.
- Maintain or increase infiltration of precipitation to recharge ground water.
- Improve the quality of runoff leaving the site.

- Leave the site in a stable condition after construction.

All runoff control methods must include provisions to safely bypass runoff in excess of the design storm.

Stabilization measures
Where appropriate, stabilize all areas disturbed by construction as soon as possible after construction to reduce the potential for erosion. When vegetation is used, refer to NRCS CPSs Critical Area Planting (Code 342) or Conservation Cover (Code 327). If vegetation is not appropriate for the site, use other measures such as NRCS CPS Mulching (Code 484) that protect the soil from erosion. Include pretreatment measures in the system as necessary to protect plantings from excessive sediment, trash, debris, or other pollutants.

Safety
Detention ponds and other areas where water is detained or flows swiftly can present hazards to the public. Where necessary, include appropriate safety features to warn of potential dangers or deter entry to hazardous areas such as with fences, gates, and warning signs.

Additional Criteria for the Reduction of Water Quantity
Design stormwater control systems to control flow from the area of concern to rates and volumes that will not cause degradation of downstream areas due to erosion or sedimentation. Acceptable peak rates and volumes are dependent upon the capacity and stability of the receiving channel. Refer to local regulations that specify acceptable discharge rates and volumes for different storm frequencies. In the absence of local requirements, use the 2-year 24-hour predevelopment storm for the peak discharge rate and volume to receiving streams.

Control the peak rate of runoff by slowing the release of runoff from the site. This can be accomplished by onsite storage, increasing infiltration onsite, lengthening the flow path of runoff, or a combination of these methods. Use one or more of these methods to reduce peak rates of runoff.

All runoff control methods must include provisions to safely bypass runoff in excess of the design storm.

Additional Criteria for the Improvement of Water Quality
Runoff from developing areas, including farmsteads, access roads, and storage areas, can be contaminated with a variety of substances including sediment, oils, chemicals, and trash. Assess site conditions to determine the type of contaminants that must be controlled. Design practices that will capture or reduce these contaminants before they leave the site. These can include diversion of clean water, vegetated filtration areas, rain gardens and other biofilters, management actions to prevent spills of fuels or other contaminants, and trash guards and settling areas that are readily accessible for cleanout. Provide a minimum of 2 feet of soil depth from bedrock to the bottom of impoundments, vegetated filtration areas, rain gardens, and other biofilters.

Additional Criteria for Erosion and Sediment Control
Control erosion on the site by limiting the amount and length of time that bare soil is exposed to precipitation. This can be accomplished by staging construction and only removing vegetation from a portion of the site at a time, revegetating areas incrementally during construction or using temporary seeding and mulching to stabilize areas until permanent vegetation can be established.

Structural erosion control practices that reduce overland flow length and velocity such as NRCS CPSs Diversion (Code 362) and Terrace (Code 600), straw bale barriers, or silt fences can be used to reduce sheet and rill erosion. Refer to the current NRCS soil loss prediction methodology to determine the appropriate spacing for these practices.

When erosion cannot be stopped at the source, filter or detain sediment-laden runoff to allow sediment particles to settle out to acceptable levels before releasing runoff from the site. This can be accomplished

by sediment traps, sediment basins, and other structures designed to detain or filter runoff. Refer to NRCS CPS Sediment Basin (Code 350) for design requirements for sediment basins.

Components

Components include but are not limited to dams, excavated ponds, infiltration trenches, parking lot storage, rooftop storage, and underground tanks. Each component shall be designed according to sound engineering principles to ensure that the system achieves its intended purpose. Design criteria for individual components shall be based on the following:

1. *Dams shall meet the requirements, specified in part 520, subpart C of the National Engineering Manual.*
2. *Excavated ponds shall meet the requirements specified for Ponds (378).*
3. *The design of infiltration trenches shall be based on such factors as soil permeability, soil depth, seepage, quality of water to be temporarily stored, foundations for adjacent buildings and structures, drainage conditions, and vegetation. Other considerations are:*
    a. *Only relatively clean water shall enter the trench to ensure that oils, grease, and sediments do not seal trench walls and bottom and thus reduce the effectiveness of the practice. At parking lots and at other areas having a similar contamination potential, filter strips; sediment traps; grease traps or filter traps, or both, shall be installed to remove objectionable materials from the water before it reaches the infiltration device. A strip of close growing grasses at least 25 ft wide must be properly placed and maintained to ensure the effectiveness of the trench. Water must move through the grass as sheet flow. If local site conditions warrant, a wider filter strip can be used.*
    b. *Trenches shall be located above the seasonal high water table.*
    c. *The size of the trench shall depend on the volume of storage required and the void ratio of the stones in the excavation. The volume of water infiltrating the walls and bottom of the trench during a storm shall be assumed to be zero in calculating the required volume. The permeability rate of the soil is used in determining the dewatering time, which shall not exceed 72 hours.*
    d. *The soils used for installing an infiltration trench must be well drained. If permeability of the surrounding soils is less than about 0.6 inches per hour, suitability of the site for an infiltration trench may not be practicable.*
    e. *An infiltration trench must not adversely affect nearby foundations for buildings, roads, and parking lots and must not impair the growth of significant woody vegetation.*
    f. *Stone used in the excavation must be poorly graded and about 1 to 2 in. in size.*
    g. *In areas where spring runoff from snowmelt is likely to occur before the trench thaws, provisions shall be made for removing the excess water.*
    h. *Provisions shall be made to ensure that salts or other soluble pollutants entering the trench do not contaminate local water supplies.*
    i. *The trench bottom and the stone surface must be level to ensure adequate storage capacity and uniform infiltration.*
4. *Parking lot storage areas can be used to help control runoff from impervious paving. Most parking lot storage area include small ponding areas that have an increased curb height and an outlet control structure. The following factors shall be considered in designing these areas:*
    a. *The practice generally used to control runoff from areas less than 3 acres in size.*
    b. *The parking lot design and installation grades must ensure positive flow to the storage area. The storage area must be nearly level, but the slope must be steep enough to facilitate drainage.*
    c. *Trash guards must be provided to prevent clogging of the outlet control device.*
    d. *Generally, ponding on the parking lot must not exceed 6 in. in areas where cars and light trucks are to be parked or 10 in. where heavy trucks are to be parked.*

e. *Emergency overflow outlets must be provided.*
f. *Such auxiliary practices as porous pavement and vegetative strips may be used in or adjacent to parking lots to permit infiltration.*

5. *For rooftop storage, the following requirements are applicable:*
   a. *The roof shall be structurally capable of holding detained storm water and of withstanding the effects of high winds and snow. Requirements for structural stability are outside the scope of this standard and shall be determined by the building designer.*
   b. *An adequate number of roof drains shall be provided.*
   c. *Emergency overflow measures shall be provided to prevent overloading if roof drains become plugged.*
   d. *Detention rings shall be placed around all roof drains in areas to be used for storage. The required number of holes or the size of openings in the rings shall be computed on the basis of the area of roof drainage per detention ring and the runoff criteria.*
   e. *Maximum time of storage on the roof shall not exceed 24 hours.*
6. *The design of underground tanks shall be based on the following criteria:*

   a. *The tank must be structurally capable of handling the anticipated loadings and be suited to the soils. Requirements for structural stability are outside the scope of this standards and must be based on sound engineering principles.*
   b. *The outlet from the tank shall not be less than 5 in. in diameter. Provisions shall be made to prevent debris from entering the tank. Debris collectors shall be placed so that the need for maintenance can be readily detected and cleaning operations easily performed.*
   c. *The bottom of the tank shall be on a slight grade to ensure complete drainage of the tank.*
   d. *Access must be provided to the tank to permit removal of sediment and other debris.*
   e. *The maximum time of storage shall not exceed 72 hours.*

Sequence of installation
Components shall be designed and installed in a sequence that permits each to function as intended without causing a hazard. Single components shall not be installed until plans for the entire runoff management system are completed.

Safety
Appropriate safety features and devices shall be installed to protect humans and animals from such accidents as falling or drowning. Temporary fencing can be used until barrier plantings are established. Such protective measures as guard-rails and fences shall be used on spillways and impoundments as needed.

Visual resource
Landscape architectural practices must ensure that all measures are visually compatible with the surrounding landscape.

Protection
A protective cover of grasses shall be established on exposed surfaces and other disturbed areas. Other protective measures, such as mulches, also can be used. Seedbed preparation, seeding, fertilizing, and mulching shall comply with recommendations in technical guides for the area.

CONSIDERATIONS

Research has shown that the first runoff from a site is often the most contaminated. After this initial flush, less pollutants are available for removal, and dilution lessens the impact. Consequently, treatment of this

“first flush” of runoff is often sufficient to address the water quality concern. The exact amount of runoff to treat varies depending upon the surface and level of contamination. Determine the amount of runoff to treat based on appropriate research or experience.

For runoff that is known to be contaminated with substances that may be particularly harmful to the water supply or fish and wildlife, additional treatment methods may be necessary.

Stormwater control practices can affect downstream hydrology. While this is the point of most stormwater control systems, consider the effect (both positive and negative) of changing the peak rate and volume of runoff on downstream areas. Where there are multiple projects in a watershed, consider the effect of a single project in context with other projects in the watershed to determine the cumulative effect. For developed areas consider options for reducing the peak flow from the current developed condition.

Design stormwater control practices that will fit into the visual landscape as well as function for runoff control. Since stormwater control practices are generally installed in public spaces, consider the use of the space and the visual impact the practices will have.

Improving or maintaining infiltration can be an important component of controlling stormwater runoff. Base the design of infiltration measures on the permeability rate of the most restrictive layer in the soil profile within the infiltration zone. Generally, soils should have a saturated hydraulic conductivity rate greater than 0.2 inches per hour. Design storage measures such as dry wells, stone trenches, and basins to empty within 72 hours.

If properly designed, stormwater control practices can be beneficial to wildlife. When possible use native vegetation to provide food and habitat for wildlife and pollinators.

To be most effective, stormwater control should include a system of practices working together. This might include detention along with infiltration areas and the maintenance of natural, undisturbed areas. However, it can also include managing the development of the site to limit the amount of disturbed area, ensuring that revegetation occurs in a timely manner and controlling where heavy equipment that will compact soils and destroy vegetation is allowed to travel on a site.

Large storms can quickly fill stormwater runoff practices with sediment. For the practices to function correctly the sediment must be removed and properly disposed of. Consequently, design these practices for easy access and maintenance.

Since stormwater control practices are often installed in urban and public spaces, vandalism may be a problem. Consider using practices that cannot be easily vandalized such as grouting rock in place and installing barriers and locks where appropriate.

Stormwater runoff control plans are often required by local regulations. As a result, the practices will often be part of a larger construction contract. To ensure that the plans will be properly implemented it is helpful to incorporate the requirements of the stormwater runoff control plan into the plans and specifications for the larger project.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for stormwater runoff control systems that describe the requirements for applying the practice according to this standard. As a minimum the plans and specifications shall include—

- A plan view showing the extent of the practice.
- Where appropriate, cross-sections and/or profiles showing elevations and distances.
- Where appropriate, plans for structural details.
- Where appropriate, seeding requirements.
- Construction specifications that describe in writing site-specific installation requirements for the

stormwater runoff control systems.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for the operator. The minimum requirements to be addressed in the O&M plan are—

- Periodic inspections, especially immediately following significant rainfall events.
- Prompt repair or replacement of damaged components, especially surfaces that are subjected to wear or erosion.
- Regular inspection of settling basins, trash guards, and other practices to collect and remove accumulated sediment and debris.
- Periodic mowing, fertilization, and control of vegetation where vegetation is specified.

REFERENCES

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