Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

ROOF RUNOFF STRUCTURE

CODE 558

(no)

DEFINITION

A structure that will collect, control, and convey precipitation runoff from a roof.

PURPOSE

This practice is used to accomplish one or more of the following purposes —

- Protect surface water quality by excluding roof runoff from contaminated areas
- Protect a structure foundation from water damage or soil erosion from excess water runoff
- Increase infiltration of runoff water
- Capture water for other uses

CONDITIONS WHERE PRACTICE APPLIES

Where roof runoff from precipitation needs to be—

- Diverted away from a contaminated area or the foundation of a structure;
- Collected and conveyed to a stable outlet or infiltration area; or
- Collected and captured for other uses such as evaporative cooling systems, livestock water, and irrigation.

CRITERIA

General Criteria Applicable to All Purposes

Evaluate the condition of the existing roof structure prior to installation of a gutter. Install new fascia boards as needed to support gutters and downspouts for the practice life span.

Mount gutters on plumb fascia boards.

Ensure that the gutter support system will withstand the anticipated loading, including loads from snow and ice, as applicable. If structural support is missing or insufficient, design the required support for the selected gutter. As an alternative to increasing the structural supports, use a ground gutter design to convey the roof runoff.

Where snow and ice damage will occur, install the roof gutter below the projection of the roof line.

Use a pipe guard or pipe casing where necessary to protect the downspout, lateral or cross-pipe pipelines of the roof runoff structure from damage by livestock or equipment.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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Gutter Design Capacity
When a roof runoff structure is used to protect roof runoff from contamination by manure, design the roof runoff structure to convey the flow rate generated from a 25-year, 5-minute rainfall event. (Refer to Agricultural Waste Management Field Handbook, NEH Part 651 Chapter 10 Appendix 10B).

For other applications, design the roof runoff structure to convey the flow rate generated from a 10- year, 5-minute rainfall event.

Downspout
Use downspouts, collector pipes, lateral downspouts or cross-pipes with a capacity equal or exceeding the roof gutter flow rate.

When a downspout outlets at the ground level, place an elbow and energy dissipation device at the outlet to provide erosion protection and direct water away from the foundation of the structure.

Ground Gutter
Where runoff from the roof eave drops onto the ground surface, provide a ground gutter with adequate provision to convey runoff away from the foundation of the structure.

Ground gutter designs can use a rock pad, a rock filled trench with a subsurface drain, a concrete channel, or a pre-cast channel to convey the roof runoff water to a stable discharge location or infiltration area. ***Up to 20% of the volume or stone in rock filled trench can be used as storage when designing the roof drain. The pipe shall be installed a minimum of two feet under the ground. Pipe shall be perforated corrugated plastic tubing or PVC pipe. Heavy duty steel or PVC pipe shall be installed in areas where heavy traffic loads are anticipated.***

Outlet
Roof runoff can empty into a subsurface drain, underground outlet, a ground gutter, a storage tank, or onto stabilized soil.

Size the outlet to ensure adequate design capacity. Provide for a clean-out of the outlet as appropriate.

Use NRCS Conservation Practice Standard (CPS) Subsurface Drain (Code 606) to design a subsurface drain used to dewater a ground gutter or infiltration ditch.

Use NRCS CPS Underground Outlet (Code 620) to design an underground outlet used to convey roof runoff to a stable outlet.

Materials
Roof gutters and downspouts may be made of aluminum, galvanized steel, wood, or plastic. Aluminum gutters and downspouts require a minimum nominal thickness of 0.027 inches and 0.020 inches, respectively.

Galvanized steel gutters and downspouts require a minimum 28 gauge. Wood may be redwood, cedar, cypress, or other species that has the desired longevity and will be free of knots. Plastics must contain ultraviolet stabilizers.

To prevent corrosion, avoid contact between components of dissimilar metals.

To enable infiltration with rock-filled trenches and rock pads use ‘poorly graded rock’ (rock fragments approximately all the same size) that is free of appreciable amounts of sand or soil particles. Do not use crushed limestone for backfill material unless it has been washed.

Use NRCS National Engineering Manual, Part 536.20, Design Criteria for Reinforced Concrete, for design and installation of reinforced concrete channels, pads or slabs.

For non-reinforced concrete channels or pads use the NRCS National Engineering Handbook, Part 642, Construction Specification 32, Structural Concrete.

Additional Criteria to Increase Infiltration

Increase runoff infiltration by directing flow to existing landscapes (e.g., lawns, mass planting areas, infiltration trenches, rain gardens, or natural areas). Ensure these areas have the capacity to infiltrate the runoff without adversely affecting the desired plant species and without creating a soil erosion problem.

Additional Criteria to Protect the Foundation of a Structure

For a design which outlets the roof runoff on the ground, slope the runoff discharge area away from the structure foundation. Use a minimum downspout extension of 5 feet to discharge runoff away from the foundation of a structure built on expansive soils or a building foundation placed on bedrock.

Additional Criteria to Capture Water for Other Uses

Design a water storage tank of adequate size, strength, and durability to hold water for the intended purpose. Install the tank on a firm, unyielding foundation. Anchor above-ground water storage tanks to prevent damage from wind loads.

Prohibit access to water storage tanks by children and animals to prevent drowning. Protect the area around the tank from erosion caused by overflow from the tank.

Construct or select water storage tanks of materials and in a manner that will not degrade the quality of the stored water. Design water supply attachments to meet system needs. Include a first flush diverter as necessary to reduce sediment, pathogens, and chemical pollutants in the collected water.

The water quality must be suitable for the intended use. The landowner is responsible for any water quality testing and treatment.

CONSIDERATIONS

Consider the use of multiple downspouts to reduce gutter size.

Discharge of outlets near wells and sinkholes or directly into drainage ditches, streams, or ponds can cause point source pollution.

Consider installation of rain gardens at the outlets to clean, transpire, and infiltrate runoff water.

When underground outlets are used, consider either a strainer at the head of the downspout, or a clean-out port on the riser pipe.

Consider the use of wrap-around straps in lieu of rigid supports on steep roofs where the outer edge of the gutter cannot be placed below the projected roof line.

On roofs subject to snow and ice slides, consider additional supports even if the gutter is installed below the projected roof line.

For cold climates, ensure the underground outlet is deep enough to avoid freezing or include a method to bypass the outlet without damage to the downspout.

PLANS AND SPECIFICATIONS

Provide plans and specifications for installing a roof runoff structure that describe the requirements for applying this practice to achieve its intended purpose. At a minimum, include the location, size, and any specific installation instructions of all gutters and spacing of downspouts, type of ground gutters, outlets, and the types and quality of material to be used.

Include plans and specifications for other practices essential for the proper functioning of the roof runoff structure.

Instruct landowner and contractor of responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, site conditions, and safety requirements. The plan will contain, but not be limited to, the following provisions:

- Keep roof runoff structures clean and free of obstructions that reduce flow.
- Make regular inspections and perform cleaning and maintenance as needed.

REFERENCES

NRCS, 2009, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Agricultural Waste Management System Component Design

NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 2, Estimating Runoff

NRCS National Engineering Manual, Part 536.20, Design Criteria for Reinforced Concrete

NRCS National Engineering Handbook, Part 642, Construction Specification 32, Structural Concrete