

ROOF RUNOFF STRUCTURE

(No.)
Code 558

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Structures that collect, control, and transport precipitation from roofs.

II. Purposes

This practice may be applied as a part of a resource management system to support one or more of the following purposes:

- Improve water quality
- Reduce soil erosion
- Increase infiltration
- Protect structures

III. Conditions Where Practice Applies

This practice applies where:

- Roof runoff structures are a component of an overall waste management system.
- Roof runoff needs to be diverted away from structures or contaminated areas.
- There is a need to collect, control, and transport runoff from roofs to a stable outlet.

IV. Federal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, state and local laws, rules, regulations or permit requirements governing roof runoff structures. This standard does not contain the text of federal, state or local laws.

V. Criteria

A. General Criteria Applicable to All Purposes

1. Design Capacity

A 10-year frequency, 5-minute rainfall precipitation event shall be used to design roof runoff structures, except where excluding roof runoff from manure management systems is

the intended purpose. In that case, a 25-year frequency, 5-minute precipitation event shall be used to design roof runoff structures (Figures 1 and 2 contain the precipitation data).

When roof gutters are used, the capacity of the downspout orifices, downspout(s), lateral downspouts, or *cross pipes*¹ must equal or exceed the gutter flow rate.

2. Outlets

Roof runoff may empty into surface or underground outlets, or onto the ground surface.

Surface and underground outlets shall be sized to ensure adequate design capacity and shall provide for clean-out as appropriate. Underground outlets shall be designed in accordance with NRCS Field Office Technical Guide (FOTG), Section IV, Standard 620, Underground Outlet.

When runoff from roofs empties onto the ground surface, a stable outlet shall be provided. When runoff is conveyed through a gutter and downspout system, an elbow and energy dissipation device shall be placed at the end of the downspout to provide a stable outlet and direct water away from the building.

Surface or ground outlets such as rock pads, rock filled trenches with subsurface drains, concrete and other erosion-resistant pads, or preformed channels may be used, particularly where snow and ice are a significant load component on roofs.

Chapter NR 812 of the Wisconsin Administrative Code requires a separation distance of 8 feet between a downspout outlet and any well.

¹ Words in the standard that are shown in italics are described in IX. Definitions. The words are italicized the first time they are used in the text.

3. Supports

The condition of existing roof structures must be evaluated prior to placement of gutters. The existing structure must have sufficient strength to support the gutters.

Gutter supports shall have sufficient strength to withstand anticipated water, snow, and ice loads. They shall have a maximum spacing of 18 inches for aluminum gutters and 24 inches for steel gutters and consist of either, a *heavy duty gutter hanger* and a roof strap, or, a heavy duty gutter hanger screwed to the fascia. For gutter sizes greater than 6 inches, maximum hanger spacing shall be reduced to 12" for aluminum gutters and 18" for steel gutters.

The need for *lateral supports* will depend on the type of gutter mount installed:

- Gutters mounted on plumb fascia boards do not need lateral supports.
- Gutters mounted on non-plumb fascia boards shall have inward lateral supports.
- Gutters not mounted on fascia boards shall have inward and outward lateral supports.

Lateral support may be provided with *wedges*, *wrap-around straps*, *rigid supports*, or any combination thereof which will provide the necessary inward and/or outward support. Lateral supports shall have a maximum spacing of 8 feet.

On roofs subject to snow and ice slides (ie. metal roofs), gutters should be mounted so the top outside edge of the gutter is placed below the extended roof line. Otherwise, the design shall include one or more of the following:

- Wrap-around straps at a maximum spacing of 8 feet.
- Rigid supports at a maximum spacing of 8 feet.
- *Snow guards* installed per manufacturer's recommendations.

Downspouts shall be securely fastened at the top and bottom with intermediate supports that are a maximum of 10 feet apart. Lateral

downspouts and cross pipes shall have supports that are a maximum of 5 feet apart.

4. Materials

Roof runoff structures shall be made of durable materials with a minimum design life of 15 years.

- a. All materials including gutters, downspouts, hangers, straps, and support components shall be as specified in Wisconsin Construction Specification 23, Aluminum or steel Roof Gutters.

- b. Outlets

Rock-filled trenches and pads shall consist of poorly graded rock (all rock fragments approximately the same size) and be free of appreciable amounts of sand and/or soil particles. Crushed limestone shall not be used for backfill material unless it has been washed.

Subsurface drains or outlets shall meet the material requirements of FOTG Standard 620, Underground Outlet.

5. Protection

Roof runoff management facilities and outlets shall be protected from damage by livestock and equipment.

Where appropriate, snow and ice guards may be installed on roofs to protect gutters and reduce the hazard to humans and animals below.

B. Specific Criteria to Increase Infiltration

Runoff shall be routed onto pervious landscaped areas (e.g., lawns, mass planting areas, infiltration trenches, and natural areas) to increase infiltration of runoff. These areas shall be capable of infiltrating the runoff in such a way that replenishes soil moisture without adversely affecting the desired plant species.

C. Specific Criteria to Protect Structures

Runoff shall be directed away from structure foundations to avoid wetness and hydraulic loading on the foundation.

On expansive soils or bedrock, downspout extensions shall be used to discharge runoff a minimum of 5 feet from the structure.

The discharge area for runoff must slope away from the protected structure.

VI. Considerations

Additional recommendations relating to design that may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation functions are as follows.

- A. Consider the use of several downspouts to reduce gutter size.
- B. When underground outlets are used consider either a strainer at the head of the downspout, or a clean-out port on the riser pipe.
- C. Avoid discharging outlets directly into surface waters.
- D. Gutters are recommended to be mounted on plumb fascia boards.
- E. On roofs subject to snow and ice slides, consider additional supports even if the gutter is installed below the extended roof line.
- F. 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 roof line projection.
- G. Consider screwing the top outside lip of the gutter to each hanger, especially where the top outside edge of the gutter cannot be placed below the extended roof line.

VII. Plans and Specifications

Plans and specifications for installing roof runoff structures shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. The plans and specifications shall show the location, spacing, size, and grade of all gutters and downspouts and type and quality of material to be used. Plans and specifications for other practices essential to the proper functioning of the roof runoff structure, such as underground outlet, shall be included.

VIII. Operation and Maintenance

An Operation and Maintenance Plan shall be developed that is consistent with the purposes of the practice, intended life, safety requirements, and the criteria for

the design. The plan shall contain, but not be limited to, the following provisions:

- A. Keep roof runoff structures clean and free of obstructions that reduce flow.
- B. Make regular inspections and perform repair or maintenance as needed to ensure proper functioning of the roof runoff structures.

IX. References

USDA, NRCS, Wisconsin Field Office Technical Guide, Section IV, Conservation Practice Standards and specifications.

USDA, NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.

X. Definitions

Cross pipes (V.A.1.) – Semi-rigid pipes (PVC) or rigid pipes used to transport runoff from a downspout orifice laterally through a building to an acceptable outlet.

Heavy Duty Gutter Hanger (V.A.3) – A gutter hanger that has self-bracing sides and/or reinforcing ribs that run the entire length of the hanger, and continue through the points of greatest stress (ie. corners). Hangers that exceed the minimum thickness and provide equivalent strength are acceptable.

Lateral Supports (V.A.3) – Rigid or non-rigid material secured to the building, gutter, and/or roof. They resist the gutter from moving inward, towards the building and/or outward, away from the building.

Rigid Supports (V.A.3.) – Rigid metal attached to the fascia board or the building and contacting the bottom of the gutter. They resist the weight of snow and ice from tearing the gutter down from the building.

Snow Guard (V.A.3.) – Devices secured to the roof to prevent snow and ice from sliding off the roof.

Wedges (V.A.3.) – A triangle shaped device installed between the back side of the gutter and a non-plumb fascia to ensure that the gutter is hung square.

Wrap-around straps (V.A.3.) – Non-rigid strips of material that are secured to the fascia board or building, wrap around the bottom and outside face of the gutter, and then secured to the roof. They resist the gutter from moving away from the building. They also resist the weight of snow and ice from tearing the gutter down from the building.

Figure 1: 10-Year, 5-Minute Rainfall (Inches)

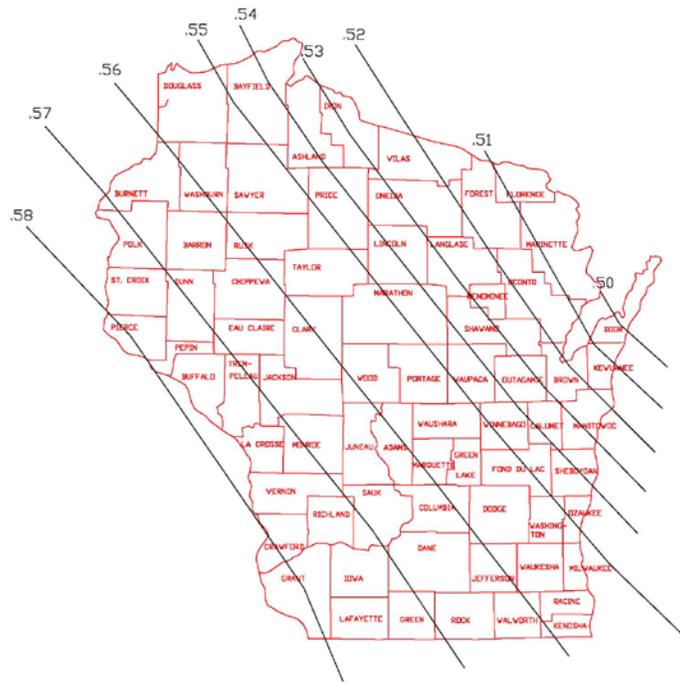


Figure 2: 25-Year, 5-Minute Rainfall (Inches)

