

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

ROOF RUNOFF STRUCTURE

CODE 558
(Reported by No.)

DEFINITION

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

PURPOSES

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

1. Improve water quality
2. Reduce soil erosion
3. Increase infiltration
4. Protect structures
5. Improve water quantity

**CONDITIONS WHERE PRACTICE
APPLIES**

This practice applies where:

1. Roof runoff structures are a component of an overall conservation management system.
2. Roof runoff needs to be diverted away from structures or contaminated areas.
3. There is a need to collect, control, and transport runoff from roofs to a stable outlet.
4. Roof runoff is collected and used for other purposes.

Such structures include but are not limited to erosion-resistant channels or subsurface drains with rock-filled trenches along building foundations below eaves, roof gutters, downspouts, and appurtenances.

CONSIDERATIONS

All disturbed land surfaces shall be vegetated or otherwise stabilized to control soil erosion. The location, layout, and design of the system should be compatible with the surrounding landscape. Avoid discharging outlets near wells or into structures that discharge directly into surface waters.

Water Quantity

Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.

Effects on downstream flows or aquifers that would affect other water used and users.

Water Quality

Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances carried by runoff.

The effects on wetlands and water-related wildlife habitats.

CRITERIA

Design

Capacity - Design of roof runoff structures shall be based on the runoff from a 10-year frequency, 5-minute rainfall except that a 25-year frequency, 5-minute rainfall shall be used to design such facilities for exclusion of roof runoff from waste treatment lagoons, waste storage structures, or similar practices. Rainfall intensities from table 1 or reliable local records may be used for design.

Roof Gutter - Roof gutters shall be K-style, half round, or box type. On opened ended rafters the rafters shall be cut vertically and a stringer (fascia board) installed. The roof gutter shall be installed so that it is free floating to allow for expansion and contrac-

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

tion. Roof gutters shall have a 5-inch minimum top width.

Down Spouts - Downspout outlets shall be positioned to avoid contamination with animal waste. Downspout outlets shall be preformed. The size selected shall be the largest size that will fit the roof gutter. The down spout size and number shall be determined by the method found in Design Guide MD #1, Roof Runoff Structure or by the following procedure. The ratio of roof drainage area to down spout cross-sectional area shall not exceed 100 square feet of roof area per one square inch of down spout area.

Supports - Gutter supports shall have sufficient strength to withstand anticipated water, snow, and ice loads. They shall have a maximum spacing of 24 inches. Spacing exceeding 24 inches shall be approved on a case by case basis. Roof gutters shall be mounted on fascia boards using hidden hangers, bolts and ferrules, gutter screws and ferrules, cradles, or by other approved methods. Spikes and ferrules shall not be used.

Fascia boards in poor condition shall be replaced. Rafters with unsound ends shall be repaired or replaced. Existing fascia boards with a nominal thickness less than 2 inches that meet the criteria found in Design Guide MD #1, Roof Runoff Structure need not be replaced.

Down spouts shall be securely fastened at the top and bottom with intermediate supports (fasteners) that are a maximum of 10 feet apart. Fasteners shall be in accordance with manufacturer recommendations.

Protection - Roof runoff structures and outlets shall be protected from damage by livestock and equipment. Where animals or equipment may come in contact with down spouts, steel pipe, schedule 40 pvc pipe, or similar materials shall be used. Gutters may be installed below the projection of the roof-line to further reduce gutter damage from snow and ice.

Vegetation

The Maryland conservation practice standard, Critical Area Planting, code 342 shall be used to determine the appropriate grass

species to be established, based on site conditions and use. Plants listed on the Maryland noxious weed list shall not be planted.

Outlets

The water from roof runoff structures may empty into surface drains or underground outlets, or onto the ground surface.

Surface Outlets - Runoff shall be directed away from structure foundations to avoid wetness and hydraulic loading on the foundation. The discharge area for runoff must slope away from protected structure. When downspouts empty onto the ground surface, there shall be an elbow to direct water away from the building and splash block or other protection shall be provided as needed to prevent erosion. On expansive soils or bedrock, downspout extensions shall be used to discharge runoff a minimum of five (5) feet from the structure.

Underground Outlets - Underground conduits shall meet the requirements specified for Underground Outlet (620) or for Subsurface Drain (606).

Materials

Roof gutters and downspouts may be made of aluminum, galvanized steel, wood or plastic. Aluminum gutters and downspouts shall have a nominal thickness of at least 0.027 inch and 0.020 inch respectively. Galvanized steel gutters and downspouts shall be at least 28 gage. Wood shall be clear and free of knots. A water-repellent preservative shall be applied to the flow area of wood other than redwood, cedar, or cypress. Plastics shall contain ultraviolet stabilizers. Dissimilar metals shall not be in contact with each other.

Wood and plastic roof gutters shall be approved by a staff engineer on a case by case basis.

All lumber used for fascia board and rafter end repair or replacement shall have a minimum nominal thickness of 2 inches. Nominal size as applied to timber or lumber, is the size by which it is known and sold in the market, and often differs from actual size. All lumber shall be preservative pressure treated (P.P.T.). Lumber shall be treated with minimum retention of 0.4 pounds per

cubic foot of chromated copper arsenate (CCA-type A, B, or C).

Trenches

Subsurface drains with rock-filled trenches under roof drip lines can be used in lieu of roof gutter. The trench shall be located so the trench centerline is along the roof dripline. Where the dripline is nearer than 12 inches to the building, the trench shall be a minimum of 24 inches wide. The depth will vary depending on topography and building location but shall not be less than 2 feet. A geotextile shall be used for soil separation, if necessary.

When backfilling the trench, place Maryland State Highway Administration #57 aggregate stone along the sides and extending 6 inches over the drain conduit. The remaining trench shall be filled with a clean coarse aggregate meeting gradations found in Maryland State Highway Administration, Standard Specifications for Construction and Materials, Section 901.

The conduit in the subsurface drain shall be perforated and shall be no smaller than 4 inches in diameter. The discharge capacity of the conduit, when combined with the temporary storage in the trench, shall be such that the roof runoff for the design storm will not overtop the side of the trench. When computing the volume of storage in the coarse aggregate use 25 percent voids.

Other

Other structures needed to collect and store water from roofs for non-potable uses such as irrigation water shall be designed and installed in accordance with the applicable NRCS conservation practice standard.

Roof runoff collected for potable use must be properly treated before use and meet the requirements of the state health department. Permits may be required for the installation of these systems. Contact the Permits Division of the local county government for regulations and permit requirements.

SPECIFICATIONS

Plans and specifications for roof runoff structure 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 quantity 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.

All phases of construction shall comply with the appropriate standards and specifications.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purpose of the developed practice; its intended life, safety requirements, and the criteria for the design. The plan shall contain, but not be limited to, the following provisions:

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

TABLE 1 RAINFALL INTENSITIES¹		
County	10 year ft./sec.	25 year ft./sec.
Allegany	0.00015	0.00017
Anne Arundel	0.00015	0.00019
Baltimore	0.00015	0.00018
Calvert	0.00015	0.00019
Caroline	0.00016	0.00019
Carroll	0.00015	0.00018
Cecil	0.00015	0.00018
Charles	0.00015	0.00019
Dorchester	0.00016	0.00019
Frederick	0.00015	0.00018
Garrett	0.00015	0.00017
Harford	0.00015	0.00018
Howard	0.00015	0.00018
Kent	0.00015	0.00019
Montgomery	0.00015	0.00018
Prince George's	0.00015	0.00019
Queen Anne's	0.00015	0.00019
Somerset	0.00016	0.00020
St. Mary's	0.00015	0.00019
Talbot	0.00016	0.00019
Washington	0.00015	0.00018
Wicomico	0.00016	0.00020
Worcester	0.00016	0.00020

¹ Converted values for the 10-year and 25-year frequency five-minute rainfalls. The values shown above are given in ft./sec.

SUPPORTING DATA AND DOCUMENTATION

Field Data and Survey Notes

The following is a list of the minimum data needed:

1. System plan sketch.
2. Dimensions of buildings, and proposed locations of downspout and underground outlets.

Design Data

Record on appropriate engineering paper. For guidance on the preparation of engineering plans see chapter 5 of the EFH, Part 650. The following is a list of the minimum required design data:

1. Plan view showing roofs that need roof runoff control and where the systems may safely outlet and construction specifications.
2. The peak runoff from each roof for the design storm selected, roof gutter and outlet design as found in worksheet 1 of Design Guide MD #1.
3. Underground outlet systems shall be sized as found in worksheet 2 of design guide MD #1.
4. Job class on plans.
5. Quantities estimate.
6. Planting plan. This must meet the criteria, specifications, and documentation requirements of the Maryland conservation practice standard, Critical Area Planting, code 342.
7. Drawings to include the following as a minimum: Plan view; roof gutter location, gage, type, size, slope, direction, and mounting instructions, underground outlet type, size direction and installation instructions, and construction specifications.
8. Written Operation and Maintenance plan.

Construction Check Data/As-built

Record on survey notepaper, SCS-ENG-28, or other appropriate engineering paper. Survey data will be plotted in red. The following is a list of minimum data needed for As-builts:

1. Documentation of site visits on CPA-6. The documentation shall include the date, who performed the inspection, specifics as to what was inspected, all alternatives discussed, and decisions made and by whom.
2. Actual location, length, size, and dimensions of the installed roof gutter and downspouts.
3. Verification of the method of mounting.
4. When applicable verify the underground outlet size, type, location, outlet type, rodent guard type, vertical distance between invert of outlet pipe and normal water in outlet stream or ditch bottom, and vertical distance between invert of outlet pipe and top of bank.
5. Final quantities and documentation for quantity changes. Materials certification.
6. Sign and date checknotes and plans to include statement that practice meets or exceeds NRCS practice standard.

REFERENCES

1. American Society for Testing and Materials, *ASTM Standards*, Philadelphia, Pennsylvania.
2. Maryland Department of Transportation, State Highway Administration, *Standard Specifications for Construction and Materials*, Baltimore, Maryland, October 1993.
3. USDA, Natural Resources Conservation Service, *Maryland Field Office Technical Guide, Section IV, Standards and Specifications*.
4. USDA, Natural Resources Conservation Service, *MD #1, Roof Runoff Structure*, MD #1, Maryland Design Guide Field Handbook.
5. USDA, Natural Resources Conservation Service, *National Engineering Handbook, Part 650*.
6. USDA, Natural Resources Conservation Service, *National Handbook of Conservation Practices*.