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

PURPOSE
This practice is applied to achieve 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.
Gutter Design Capacity. Roof runoff shall be diverted from feedlots, animal waste storage structures, composting facility structures, and agrichemical handling or storage facilities. Design these types of roof runoff structures to convey the flow rate generated from a 25-year, 5-minute rainfall event. If roof runoff will not contaminate any material or associated practices that would create a resource concern, use the flow rate generated from a 10-year, 5-minute rainfall event to the design the roof runoff system. Rainfall data can be found on the Ohio e-FOTG web site under Section II/ Climatic Data/ 5. Precipitation Depths by Average Recurrence Interval (data from NOAA- NWS web site).

Downspout. Use vertical downspouts with enough capacity to carry the design flow from the roof area runoff being captured. The capacities of collector pipes, lateral downspouts, and diagonal downspouts must meet or exceed the capacities of the vertical downspouts above them. Gutter and downspout capacity shall be determined by using the Ohio NRCS "Roof Runoff- Gutter/Downspout Design" spreadsheet. The spreadsheet can be found on the Ohio NRCS web site by selecting Ohio Engineering on the home page and then by selecting Engineering Software from the Engineering home page.

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.

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. One (or more) orifices shall be installed (if needed) to protect the underground outlet from pressure flow conditions.

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

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

Materials. Roof runoff structures shall be made of durable materials with a minimum design life of ten years. Roof gutters and downspouts may be made of aluminum, galvanized steel, wood, or plastic. Aluminum gutters and downspouts require a minimum nominal thickness of 0.032 inches (20 gauge) and 0.019 inches (24 gauge), respectively. Galvanized steel gutters and downspouts require a minimum 28 gauge (0.019 inches). 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. Subsurface drains or outlets shall meet the material requirements of the applicable NRCS conservation practice standard.

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, Structure Concrete.
The design criteria for all concrete appurtenances can be met by following the requirements of the current edition of the Ohio Design and Construction Specification- Concrete. This specification can be found on the Ohio NRCS web site by selecting Ohio Engineering on the home page and then by selecting Construction and Material Specifications from the Engineering home page. Precast concrete appurtenances shall meet the requirements of the National Precast Concrete Association’s quality procedures and guidelines.

**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 five (5) feet to discharge runoff away from the foundation of a structure built on expansive soils or a building foundation placed on bedrock.

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

**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.
Some designs may provide secondary benefits, e.g. rock pads may also reduce rodent problems around livestock and poultry barns.

Do not place the drip trench where it could increase the loading on a new or existing structure. Locate the drip trench away from the structure such that the projected drip line hits approximately in the center of the drip trench. A drip trench may be located very near or at the top of a wall footer. Exercise care when digging a trench that is being installed at an existing structure so that walls, footers, and/or wood posts are not damaged or compromised.

Consider the size of the fascia board when selecting the gutter slope to insure proper mounting of the gutter. Gutter gradients shall be as shown on the drawings with a recommended slope of 1 inch per 16 feet. The gradient of the gutter is to be sufficient to meet the designed capacity requirements and at the same time be constructible.

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, slope, and any specific installation instructions of all gutters and spacing of downspouts, types of ground gutters, outlets and the types and quality of materials to be used.

Include plans and specifications for other practices essential for the proper functioning of the roof runoff structure, including but not limited to a subsurface drain, underground outlet, and/or ground gutter (rock pad; rock-filled trench; concrete pad, etc.). A stable discharge location is to be shown for these practices.

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


GUTTERS AND DOWNSPOUTS

Materials

Roof gutters and downspouts will be the type and size specified on the drawings. All gutter and downspout joints shall be made water-tight by use of mastic or caulking.

1. Aluminum and Steel
   a. Gutters, downspouts, and associated hardware shall be aluminum with baked enamel finish, galvanized steel, painted steel, or coated galvanized steel. Dissimilar metals shall not be in contact with each other.
   b. Accessories for gutters or downspouts shall be of like materials. Hardware and accessories shall be of sufficient strength to secure the gutters and downspouts.
   c. Aluminum and steel items shall have the following minimum thicknesses:

<table>
<thead>
<tr>
<th>Item</th>
<th>Aluminum Material</th>
<th>Galvanized Steel; Painted Steel; Coated Galvanized Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gutters</td>
<td>0.032 in. (20 gauge)</td>
<td>0.019 in. (28 gauge)</td>
</tr>
<tr>
<td>Downspouts</td>
<td>0.019 in. (24 gauge)</td>
<td>0.019 in. (28 gauge)</td>
</tr>
<tr>
<td>Heavy-duty Hangers</td>
<td>0.060 in. (15 gauge)</td>
<td>0.064 in. (16 gauge)</td>
</tr>
<tr>
<td>Roof Straps</td>
<td>0.060 in. (15 gauge)</td>
<td>0.046 in. (19 gauge)</td>
</tr>
<tr>
<td>Wrap-around Straps</td>
<td>0.032 in. (20 gauge)</td>
<td>0.019 in. (28 gauge)</td>
</tr>
</tbody>
</table>

   1/ Heavy-duty Hangers have self-bracing sides and/or reinforcing ribs that run the entire length of the hanger.

2. Plastic (PVC)
   a. PVC plastic downspouts may be used as an option in lieu of aluminum or galvanized steel downspouts. The pipe shall meet the minimum strength requirements of ASTM D3034 SDR 35 non-pressure PVC pipe. ASTM D1785 Schedule 40 pressure PVC pipe may also be used to match the downspout pipe material to the underground pipe material (when pressure-rated pipe is used for the underground pipe that the downspout will be attaching to).
   b. Plastic shall contain ultraviolet stabilizers.
3. Wood
   a. A water-repellent preservative shall be applied to the flow area of wood gutters unless the wood species is cedar, redwood, or cypress.
   b. New fascia board (treated/untreated) shall be straight and graded lumber #2 or better and shall be sound and free of knots. If treated lumber is used as fascia, wedges, or rigid supports, it shall have treatment retention applicable for exterior, above ground use and be non-corrosive to aluminum and steel. Lumber treated with ACQ, AC2, or other corrosive preservatives are not acceptable unless a waterproof coating is applied between the lumber and the gutter

Supports
1. Gutters
   a. Gutter supports (heavy-duty hangers or straps) shall be installed as recommended by the manufacturer. They shall have a maximum spacing of 24 inches for steel gutters and 18 inches for aluminum gutters.
   b. Spikes and ferrules shall not be used.
   c. Wood gutters shall be mounted on fascia boards using furring blocks that are a maximum of 24 inches apart. Wedge-shaped stringers may be used for support and/or spacing.

2. Downspouts
   a. Straight downspouts shall be securely fastened at the top and bottom of a post and have intermediate supports that are spaced no more than 10 feet apart.
   b. Lateral and/or diagonal downspouts shall have supports that are a maximum of 5 feet apart.

Installation
1. Gutters
   a. Gutter placement shall be as shown on the construction drawings.
   b. Gutter gradients shall be as shown on the drawings. The gradient of the gutter is to be sufficient to meet the designed capacity requirements and at the same time be constructible.
   c. Gutters shall be placed below the roof slope line so ice and snow can slide clear. The top outer edge of the gutter shall be ½ inch below the projected roof slope line on roofs with pitches steeper than 12H:5V and ¾ inch below on roofs with pitches of 12H:5V or flatter.

2. Downspouts
   a. Downspout placement shall be in the locations shown on the construction drawings.

Outlets
1. Outlet facilities shall be installed as shown on the construction drawings.
2. Outlets may be surface or ground outlets such as rock pads, rock filled trenches with subsurface drains, concrete and other erosion-resistant pads, or preformed channels.
3. When a downspout empties onto the ground surface, an elbow and energy dissipating device (as listed above) shall be placed at the end of the downspout to direct water away from the building and provide a stable outlet to minimize the potential for erosion.
DRIP TRENCHES

Materials

1. Gravel material used to fill the drip trench shall be washed and free of fines.
2. Gradation of the gravel material shall be as shown on the construction drawings.
3. No compaction of the gravel material shall be required.
4. Pipes used as drains shall conform to the sizes and materials specified on the construction drawings. All joints shall be secure and inspected prior to placing gravel material over the pipe.

Outlets

1. The outlet(s) for the drip trench pipe(s) shall be located so as to be free-flowing and protected from animal and equipment damage.
2. The outlet shall have an animal guard of appropriate size and type installed.
3. The outlet shall be located to minimize erosion and flooding.

CONSTRUCTION COMPLETION

1. Upon completion of construction, all disturbed areas shall be graded to drain and seeded and mulched in accordance with Ohio Practice Standard 342- Critical Area Planting.
2. Seeding and mulching materials shall be as specified on the construction drawings.
3. Necessary fencing shall be installed according to the requirements of Ohio Practice Standard 372-Fencing.